

BRIEF OF THE MEDICAL AND BIOLOGICAL PROGRAMS  
RESEARCH DIVISION  
BUREAU OF MEDICINE AND SURGERY  
PREPARED FOR THE INSTITUTE OF DEFENSE ANALYSIS  
DECEMBER 2, 1961

FOR OFFICIAL USE ONLY

MEDICAL AND BIOLOGICAL PROGRAM REVIEW

RESEARCH DIVISION  
BUREAU OF MEDICINE AND SURGERY  
DEPARTMENT OF THE NAVY

INDEX

Surgeon General's Remarks.....	1-6
Mission...Concept...Organization.....	7-8
Facility Map.....	9
Administrative Organization.....	10
Program Organization.....	11-12
Fiscal.....	13-17
Personnel.....	18
In-House Research.....	19-47
Program Briefs.....	48-57
Research in Naval Hospitals.....	58-60
Dental Research.....	61-62
Limited Warfare Statement.....	63-67
Future Research Requirements.....	68-71
Addendum.....	72-85

REMARKS BY REAR ADMIRAL E. C. KENNEY, MC, USN, SURGEON GENERAL,  
DEPARTMENT OF THE NAVY, BEFORE THE INSTITUTE FOR DEFENSE ANALYSIS,  
DECEMBER 2, 1961

MR. CHAIRMAN, GENTLEMEN:

I APPRECIATE THE OPPORTUNITY TO DISCUSS WITH YOUR DISTINGUISHED  
MEMBERSHIP THE BIO-MEDICAL EFFORTS WITHIN THE DEPARTMENT OF THE NAVY.  
I SHALL TRY TO RELATE OUR PLANS, PROGRAMS AND PROJECTIONS TO THE ANTICIPATED  
REQUIREMENTS OF THE NAVY AS A WHOLE THROUGH 1970. TODAY I WOULD  
LIKE TO DISCUSS MEDICAL DEPARTMENT REQUIREMENTS IN TERMS OF MISSIONS  
AND THE CHANGING DEMANDS OF MODERN WEAPONRY. I WILL BE AVAILABLE TO  
DISCUSS, AT THE CONVENIENCE OF THE COMMITTEE, MEDICAL DEPARTMENT PROGRAMS  
AND PROGRAM DETAILS.

THE PRIMARY MISSION OF THE BUREAU OF MEDICINE AND SURGERY IS TO  
PROVIDE THE HIGHEST LEVEL OF MEDICAL AND BIOLOGICAL SUPPORT TO THE  
OPERATING FORCES: PERSONNEL..FACILITIES..PROFESSIONAL COMPETENCE.....  
RESEARCH CAPABILITIES AND STRATEGIC BIO-INFORMATION. IT IS ESSENTIAL  
THAT WE ANTICIPATE THE DEMANDS OF RAPIDLY CHANGING WEAPONS SYSTEMS AND  
WARFARE TECHNIQUES..IDENTIFY PERSONNEL REQUIREMENTS..THE NEED FOR  
SPECIALIST CADRES..DEFINE PARAMETERS OF HUMAN PERFORMANCE WITHIN THE  
CLOSED ENVIRONMENT AND THE EXTREMES OF ALTITUDE, ACCELERATION, THERMAL  
AND PSYCHOLOGICAL STRESS. THESE PLANS AND PROGRAMS MUST BE INTEGRATED  
WITHIN THE DAY TO DAY REQUIREMENTS FOR THE CARE OF THE SICK..WE MUST KEEP  
"AS MANY MEN AT AS MANY GUNS AS MANY DAYS AS POSSIBLE".

I WOULD EMPHASIZE TRAINING AS THE MOST IMPORTANT REQUIREMENT OF THE  
PEACE-TIME NAVY, AND A FIRST PRIORITY REQUIREMENT IN TIME OF WAR. TO  
SUPPORT TRAINING REQUIREMENTS WE ROUTINELY ASSIGN APPROXIMATELY TEN

PERCENT OF OUR OFFICER AND ENLISTED LINES TO COURSES OF INSTRUCTION (RESIDENCY TRAINING IN NAVAL AND CIVILIAN HOSPITALS, GRADUATE WORK IN CIVILIAN INSTITUTIONS, SPECIAL SERVICE SCHOOLS, SPECIAL COURSES IN SUBMARINE MEDICINE, RADIobiOLOGY, ABC WARFARE, AVIATION MEDICINE, PREVENTIVE MEDICINE, ETC.) TECHNICAL TRAINING IS AVAILABLE AT THREE LEVELS (A-B-C SCHOOLS) FOR ENLISTED PERSONNEL AND SPECIAL EXTRAMURAL ACADEMIC TRAINING FOR OUR CIVILIAN COMPONENTS. THE COMPLEX ENVIRONMENTS OF THE HIGH PERFORMANCE AIRCRAFT, THE NUCLEAR POWERED SUBMARINE, THE HOT-WET-HOT-DRY TROPICS, AND THE COMPLEX TOXICOLOGY OF NEW PROPELLANTS, GENERATE CONTINUING REQUIREMENTS FOR THE HIGHLY TRAINED BIOMEDICAL SPECIALISTS.

FUNDAMENTAL TO THE SUCCESS OF THE ENLISTED TRAINING PROGRAMS IS THE ABILITY TO ATTRACT, IDENTIFY, SELECT, MOTIVATE AND RETAIN A CROSS SECTION OF YOUNG AMERICA CAPABLE OF MEETING THE REQUIREMENTS AND ACCEPTING THE RESPONSIBILITIES OF THE 1961-1970 NAVY. WE MUST NOT ONLY IDENTIFY THE INDIVIDUAL WHO WILL PERFORM SUCCESSFULLY..IT IS EquALLY IMPORTANT THAT WE IDENTIFY EARLY THE POTENTIAL PSYCHIATRIC AND PSYCHOLOGICAL CASUALTY. TO MEET CHANGING PERSONNEL REQUIREMENTS WE HAVE ESTABLISHED A NEUROPSYCHIATRIC RESEARCH LABORATORY AT SAN DIEGO, WHERE LONGITUDINAL STUDIES ON THE INCOMING RECRUITS, BOTH NAVY AND MARINE CORPS ARE IN PROGRESS. STUDIES DESIGNED TO REDUCE THE PSYCHIATRIC, BEHAVIORAL AND APTITUDE DISCHARGES NOW IN EXCESS OF TEN THOUSAND EACH YEAR. THE ANNUAL DOLLAR COST FOR HOSPITALIZATION EXCEEDS EIGHT MILLIONS.

THE STRENGTH OF THE NAVY AS ESTABLISHED BY THE CONGRESS DETERMINES IN GENERAL OUR FACILITY REQUIREMENTS (HOSPITALS, DISPENSARIES, SHIPS

MEDICAL DEPARTMENTS, AND OUTPATIENT FACILITIES). THE CHANGING PATTERN OF MEDICAL PRACTICE WITH EXPANDING CAPABILITIES FOR OUTPATIENT CARE HAS EMPHASIZED THE INNUMERABLE PROBLEMS OF ADAPTING A CONVENTIONAL HOSPITAL TO THE REQUIREMENTS OF AN EFFECTIVE AND EFFICIENT OUTPATIENT SERVICE. WE ARE CURRENTLY ENGAGED IN AN ADMINISTRATIVE AND PROFESSIONAL REVIEW OF OUR OUTPATIENT OPERATIONS DESIGNED TO IDENTIFY THE PROBLEM REALISTICALLY AND DEFINE THE FACILITY AND PROFESSIONAL REQUIREMENTS FOR THE CARE OF APPROXIMATELY TWO MILLION DEPENDENTS. WE ARE DIRECTING OUR ATTENTION TO THE "OUTPATIENT HOSPITAL OF THE FUTURE".....AN OUTPATIENT CENTER FOR RAPID DIAGNOSIS, ACCURATE THERAPEUTICS AND EFFECTIVE PREVENTIVE PROGRAMS. THE LEVEL OF EMPHASIS IN THE BROAD AREA OF OUTPATIENT CARE.. THE ASSIGNMENT OF FUNDS....AND THE AVAILABILITY OF PERSONNEL HAS BEEN A CONTINUING CHALLENGE TO THE MEDICAL MILITARY PROFESSION.

GENTLEMEN, I AM DELIGHTED TO HAVE THIS OPPORTUNITY TO DISCUSS PAST ACTIONS IN AREAS OF FUTURE IMPORTANCE TO AIR, SUBMARINE, AND AMPHIBIOUS OPERATIONS. ANTICIPATING THE DEVELOPMENT OF HIGH SPEED, HIGH PERFORMANCE, HIGH ALTITUDE AIRCRAFT WITH HIGH PILOT STRESS FACTORS, THE NAVY IN 1952 COMMISSIONED THE AVIATION ACCELERATION LABORATORY, JOHNSVILLE, PA., FOR THE PURPOSE OF DETERMINING THE EFFECT OF RAPID ACCELERATION AND DECELERATION UPON THE HUMAN ORGANISM..THE PROBLEMS OF MAN-MACHINE INTEGRATION AND THE PARAMETERS OF DECISION-MAKING UNDER VARYING STRESSES. IN 1955, (PLANNING BEGAN IN 1947) THE NAVY BEGAN CONSTRUCTION OF A HUMAN ANGULAR ACCELERATION DEVICE DESIGNED TO MEASURE THE EFFECT OF COMBINED ACCELERATIVE VECTORS. IN 1959, THE NAVY DESIGNED THE FIRST ROTATING ROOM FOR THE STUDY OF DISORIENTATION IN FIELDS OF

SLOW ROTATION. THESE THREE INSTRUMENTS HAVE PROVIDED A REPOSITORY OF BIO-MEDICAL INFORMATION ESSENTIAL NOT ONLY TO THE SAFE AND SUCCESSFUL OPERATION OF AIRCRAFT, BUT OF MAJOR IMPORTANCE TO "PROJECT MERCURY" AND THE RECENTLY IDENTIFIED PROBLEMS OF PROLONGED SPACE FLIGHT AT ZERO GRAVITY.

THE NAVAL MEDICAL RESEARCH LABORATORY, NEW LONDON, CONNECTICUT, WAS ESTABLISHED IN 1946 FOR THE STUDY OF THE MEDICAL ASPECTS OF THE CONVENTIONAL SUBMARINE. BASIC STUDIES DESIGNED TO DEFINE AND EXTEND THE RESTRAINTS OF THE SUBMARINE ENVIRONMENT HAVE MADE POSSIBLE THE SUCCESSFUL TRANSITION FROM DIESEL TO NUCLEAR PROPULSION..FROM A MAXIMUM SUBMERGENCE OF SEVENTY-TWO HOURS TO SIXTY DAYS OR MORE.

IN 1943, A FIELD RESEARCH LABORATORY WAS ESTABLISHED AT CAMP LEJEUNE, NORTH CAROLINA, WITH THE ASSIGNED MISSION OF DEVELOPING CONCEPTS, DOCTRINE, MEDICAL TECHNIQUES AND FIELD EQUIPMENT FOR THE SPECIAL REQUIREMENTS OF THE U. S. MARINE CORPS. RUGGED MULTI-PURPOSE FIELD EQUIPMENT, LIGHT PERSONNEL ARMOR, RAPID EVACUATION TECHNIQUES, AND A SUPPORT FLEXIBILITY DESIGNED TO PROVIDE DEFINITIVE MEDICAL CARE WITHIN MINUTES OF THE FRONT LINE, CONTRIBUTED TO THE HISTORY MAKING SUCCESS OF MARINE OPERATIONS IN KOREA. TODAY, GENTLEMEN, WE HAVE THREE COMBAT-READY MARINE DIVISIONS SUPPORTED BY NAVAL MEDICAL OFFICERS WHO ARE GRADUATES OF THE FIELD MEDICAL SERVICE SCHOOLS AND REINFORCED BY TEN TRAINED SURGICAL TEAMS AVAILABLE FOR DEPLOYMENT ON FOUR HOURS NOTICE. (THE FORMATION OF TWENTY-FOUR ADDITIONAL SURGICAL TEAMS WITHIN THE RESERVE COMPONENTS HAS BEEN APPROVED).

LIMITED WARFARE IN THE REMOTE, LESS KNOWN BUT STRATEGIC AREAS OF THE WORLD IS A CURRENT THREAT. TO INCREASE OUR KNOWLEDGE OF THE MEDICAL PROBLEMS AND THE ENVIRONMENT OF THE NEAR EAST, WE ESTABLISHED IN 1946, A NAVAL MEDICAL RESEARCH UNIT (NAMRU-3) IN CAIRO, UAR DESIGNED AS A COLLABORATIVE EFFORT WITH THE EGYPTIAN MINISTRY OF HEALTH FOR THE STUDY OF ENDEMIC AND EPIDEMIC DISEASES OF THIS AREA AND SECONDARILY, PROVIDING AN OPPORTUNITY FOR OUR MEDICAL OFFICERS TO BECOME PROFICIENT IN THE MANAGEMENT OF THE DISEASES OF THAT PART OF THE WORLD.

IN 1957, WE ESTABLISHED A MEDICAL RESEARCH LABORATORY (NAMRU-2) IN TAIPEI, TAIWAN, REPUBLIC OF CHINA, AGAIN DESIGNED TO STUDY THE ENDEMIC AND EPIDEMIC DISEASES OF MILITARY IMPORTANCE IN THE FAR EAST..AND TO COLLABORATE WITH OUR ALLIES IN SOUTHEAST ASIA. OVER THE PAST THREE YEARS, THIS LABORATORY HAS PURSUED AN INTENSIVE STUDY OF CHOLERA. THE IMPORTANCE OF THIS OLD BUT NONE THE LESS DANGEROUS DISEASE IN FAR EAST OPERATIONS HAS BEEN EMPHASIZED BY THE RECENT CHOLERA EPIDEMICS IN RED CHINA, HONG KONG, AND TODAY IN MANILA. WITH THE INCREASING STRATEGIC IMPORTANCE OF THE NEAR AND FAR EAST WE PROPOSE TO INCREASE OUR RESEARCH EFFORTS IN SUPPORT OF MILITARY COMMITMENTS IN THESE REMOTE AREAS.

THE AVAILABILITY OF JET AIRCRAFT FOR THE RAPID TRANSPORT OF TROOPS HAS FOCUSED OUR ATTENTION ON THE PHYSIOLOGICAL FACTORS OF ACCLIMATIZATION AND THE ABILITY TO MAINTAIN COMBAT EFFICIENCY UNDER RAPIDLY IMPOSED ENVIRONMENTAL EXTREMES. THIS, GENTLEMEN, IS A TREMENDOUS PROBLEM... HISTORY HAS SHOWN THAT A MAJOR FACTOR IN THE SUCCESS OF MILITARY OPERATIONS IN THE TROPICS WILL BE THE HEALTH OF THE COMMAND.

THE PROPOSAL BY SECRETARY RIBICOFF FOR SYSTEMATIC AND COOPERATIVE ACTION BY SELECTIVE SERVICE AND HEW (NATIONAL, STATE, AND LOCAL HEALTH AGENCIES) TO PROVIDE SUPERVISORY MEDICAL SERVICES FOR THOSE UNABLE TO MEET THE PHYSICAL REQUIREMENTS OF THE MILITARY SERVICE IDENTIFIES AN EXCEPTIONAL OPPORTUNITY IN THE FIELD OF PREVENTIVE MEDICINE. THE PSYCHIATRIC AND PSYCHOLOGICAL CASUALTY OF THE RECRUIT DEPOT IS, ALMOST WITHOUT EXCEPTION, THE PROBLEM CHILD OF THE PRIMARY SCHOOL.

THE VALIDITY OF EXISTING PHYSICAL STANDARDS FOR ENTRY INTO THE MILITARY SERVICE AND THE VALIDITY OF EXISTING PHYSICAL RISK QUALIFICATIONS MUST BE REVIEWED AND RECONSIDERED IN THE LIGHT OF CHANGING REQUIREMENTS FOR TECHNICAL SKILLS AS OPPOSED TO PHYSICAL STAMINA. PHYSICAL STANDARDS MUST REALISTICALLY REFLECT MAN-POWER AVAILABILITY.

AGAIN, GENTLEMEN, I APPRECIATE THIS OPPORTUNITY TO APPEAR BEFORE YOU. IT WILL BE A PLEASURE TO EXTEND THIS DISCUSSION AT YOUR CONVENIENCE.

MISSION AND PHILOSOPHY

MEDICAL AND BIOLOGICAL PROGRAMS

RESEARCH DIVISION  
BUREAU OF MEDICINE AND SURGERY  
DEPARTMENT OF THE NAVY

THE MISSION:

It is the mission of the Research Division to:

- (1) Support the Operating Forces
- (2) Anticipate the rapidly changing demands of modern Weapons Systems
- (3) Identify and define methods for maintaining maximum health and efficiency of Naval personnel and
- (4) Maintain a cadre of military and civilian scientists responsive to the research requirements of the Navy world wide.

THE CONCEPT:

It is the philosophy of the Research Division that the best in medical research originates at the working level, originates with the scientist directly associated with the operational problem and is best accomplished by scientific task forces working in close proximity or within the problem area.

THE ORGANIZATION:

To deliver the maximum research support to the operating forces ....maintain a rapid response capability and administrative flexibility, the Research Division has:

- (1) Placed four major laboratories within operational Commands:
  - (a) The Naval School of Aviation Medicine,  
Naval Air Training Command, Pensacola, Florida
  - (b) The Naval Medical Research Laboratory,  
Submarine Base New London, Groton, Connecticut
  - (c) Naval Medical Field Research Laboratory,  
Marine Corps Base, Camp Lejeune, North Carolina
  - (d) Naval Medical Research Unit No. 4, Naval Training Station, Great Lakes, Illinois

(2) Established Laboratories in strategic areas overseas:

- (a) Naval Medical Research Unit No. 3, Cairo, U.A.R.
- (b) Naval Medical Research Unit No. 2, Taipei, Taiwan
- (c) Sub-unit of NAMRU-3, Malakal Republic of Sudan

(3) Organized Clinical Research Facilities in six Naval Hospitals:

- (a) St. Albans Naval Hospital, New York
- (b) Oakland Naval Hospital, California
- (c) Bethesda Naval Hospital, Maryland
- (d) Chelsea Naval Hospital, Massachusetts
- (e) Portsmouth Naval Hospital, Virginia
- (f) Jacksonville Naval Hospital, Florida

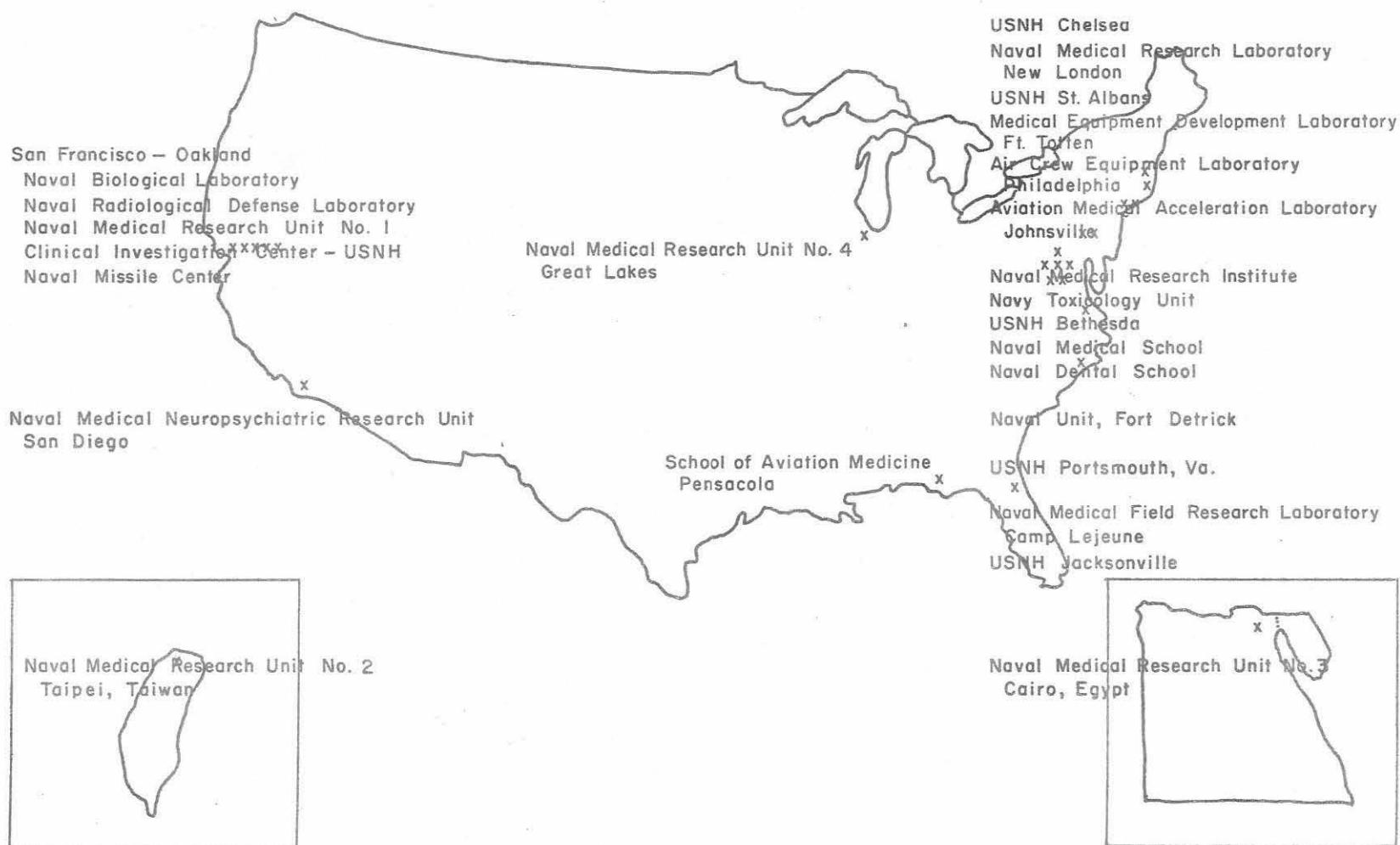
(4) Within the past year assigned Scientific Task Groups to the following areas:

- (a) Thailand
- (b) Pakistan
- (c) Phillipines
- (d) North Borneo
- (e) Okinawa
- (f) Orchid Islands
- (g) Ethiopia

(5) Continued to emphasize the importance of conventional and limited warfare in the remote and less known areas of the world.

(6) Supported Operational, Basic and Clinical Research throughout the Department of the Navy.

## MEDICAL RESEARCH FACILITIES



ADMINISTRATIVE ORGANIZATION

1. Medical research laboratories under the administrative control of the Bureau of Medicine and Surgery:

- |           |           |
|-----------|-----------|
| a. NMRI   | f. NMRU-3 |
| b. NMRL   | g. NMRU-4 |
| c. SAM    | h. NMFRL  |
| d. NMRU-1 | i. NMNRU  |
| e. NMRU-2 | j. NTU    |

2. Laboratories with Medical divisions under the management control of other bureaus, Department of the Navy:

- a. NRDL (BUSHIPS)
- b. AMAL (BUWEPS)
- c. ACEL (BUWEPS)
- d. P.M.R. (BUWEPS)

3. Triservice Medical Laboratories:

- a. Fort Detrick (Army)
- b. MEDL (Army)

4. Medical Research Contracts (Current):

- a. Dr. William J. Mills
- b. Arthur D. Little Company
- c. University of California (3)
- d. Protein Foundation
- e. University of Pennsylvania
- f. Georgetown University
- g. National Research Council (2)

5. Medical Research Laboratories in Naval Hospitals:

- a. St. Albans, New York
- b. Chelsea, Mass.
- c. Portsmouth, Va.
- d. Bethesda, Md.
- e. Oakland, Calif.

## RESEARCH PROGRAM ADMINISTRATION

The Bureau of Medicine and Surgery's research program is organized to conduct applied and basic research in ten scientific areas basic to Naval medicine and fleet operations. The term "research project" is defined as an approved specific area of research appearing in the budget as a line item.

The research projects are:

MR 005.01 - Stress Physiology: Adaption to climatic extremes and high altitudes, for example.

MR 005.02 - Blood and Tissue Transplantation and Substitutes: Studies of basic principles attending preservation and transplantation of these substances, including: metabolic, genetic, and immuno-chemical studies of host-donor response; and management and control of traumatic injuries and various disease states.

MR 005.03 - Regulatory Physiology: Includes the functioning of nerves and hormones.

MR 005.04 - Toxicology: Study of toxic agents to determine effects of chronic, as well as acute exposure to chemicals used as fuels, propellants, etc., and metabolic products ( $\text{CO}_2$ ).

MR 005.05 - Microbiology: Studies on basic mechanisms of microbial activities, including metabolic and biochemical activities, microbial genetics, ecology, pathogenesis of microbial diseases, and microbial deterioration of naval materials.

MR 005.06 - Biochemistry: Includes problems of energy exchange mechanisms, enzyme reactions, chemistry of immune reactions, and protein structure and functions.

MR 005.08 - Biophysics: The study of physical phenomena in biological systems and the application of physical techniques and concepts to biological problems.

MR 005.09 - Control and Prevention of Disease: Due to infectious agents or metabolic and functional disturbances under natural or military situations.

MR 005.12 - Naval Medical and Dental Problems:

MR 005.13 - Aviation and Astronautical Medicine: Medical studies in human factors as they specifically relate to aircraft operations and biological systems in space flight.

MR 005.14 - Submarine and Shipboard Medicine: Studies in the medical aspects of, and problems peculiar to underwater and surface naval operations including improvement of habitability of vehicles.

TASKS -

Each research project is supported by tasks assigned to the individual laboratories on the basis of available personnel, instrumentation and interest of the investigators. The task titles are broad and the same task may be assigned to more than one laboratory. A task may, in addition, be accomplished by contracts with universities, non-profit institutions or industry.

SUBTASKS -

A subtask is a proposal for research to be conducted by an individual investigator in support of the laboratory task.

RESEARCH PROPOSALS -

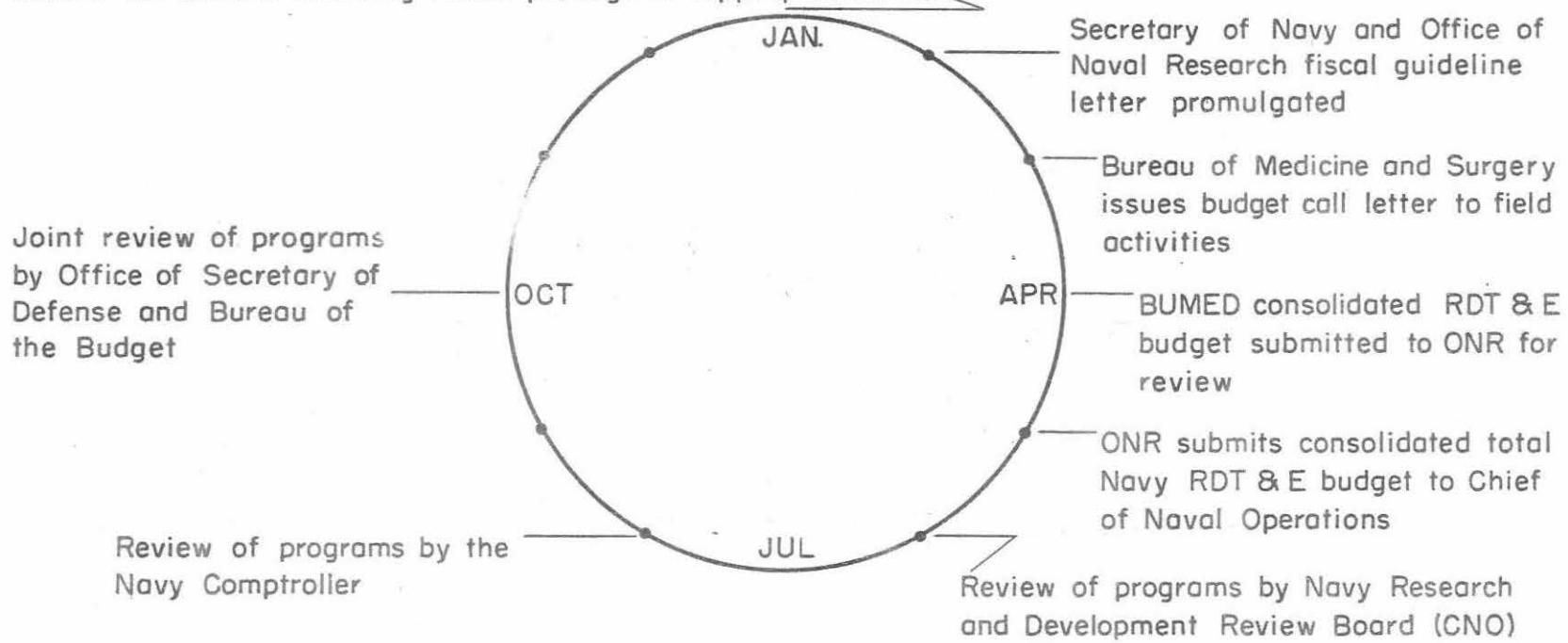
Research proposals routinely originate with the laboratory staff in support of the laboratory tasks. The proposals and protocols reflect the local operational problems, the individual's interest and capability, available instrumentation, and funds to support the proposal.

REVIEW OF RESEARCH PROPOSALS -

Research proposals originating with individual staff members are reviewed by the parent laboratory in relation to funds, personnel, equipment and the laboratory's overall program. The proposal is then reviewed by a research committee in the Bureau of Medicine and Surgery in relation to the Bureau's program and needs. Technical aspects of the proposal are approved or disapproved after review by consultants within the Naval establishment, the NRC Committee, by NRC Ad Hoc Committees of the Research Council, or special consultants to the Bureau of Medicine and Surgery. The time required for the above (within ten days) review is minimal. The Commanding Officers of the laboratories have authority to initiate pre-approval pilot studies in urgent or promising research areas.

## BUDGET CYCLE

Budget hearings before the House of Representatives; and  
before the Senate following House passage of Appropriation Act



## FISCAL

### ● SOURCES OF FUNDS

1. New Obligational Authority approved in the Appropriation Act
2. Transfers from other Navy Bureaus or Offices
3. Transfers from Department of Defense or other Federal Government Agencies
4. Carry-over of funds unobligated in prior years

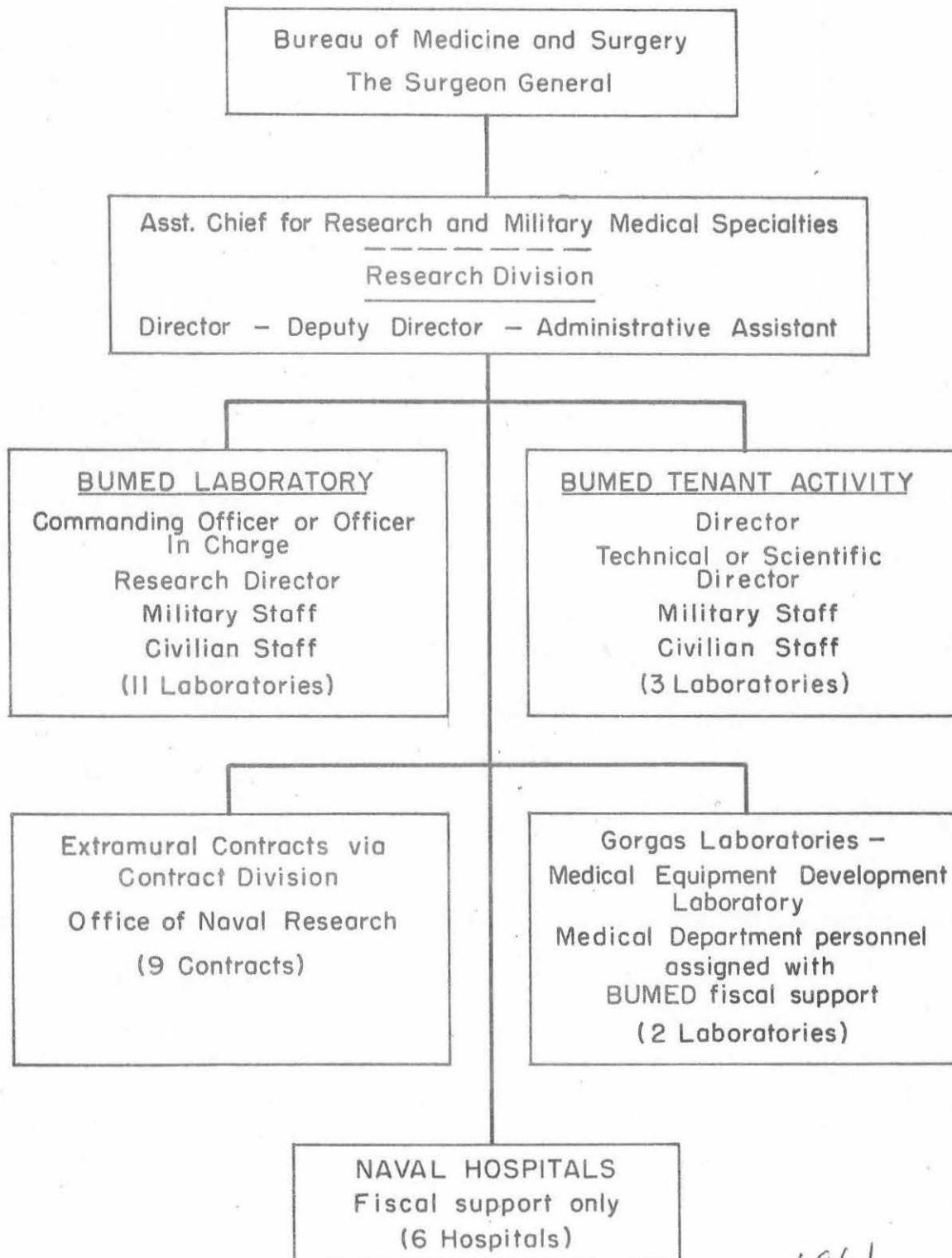
### EXAMPLE —

Fiscal Year 1962	
New Obligational Authority	6,192,000
Defense Atomic Support Agency	221,000
National Aeronautics and Space Administration	433,470
Bureau of Ships	20,000
United States Marine Corps	80,000
Office of Naval Research	10,500
Carry - over funds	236,743

### ● EXPENDITURES

1. Allotments issued to field activities as of 1 July
2. Increases to allotments for special or emergency projects
3. Transfers to Office of Naval Research for funding of contracts
4. Transfers to Department of Defense or other Federal Government Agencies
5. At the Bureau level expenditures are made for (1) payment of bills, (2) transportation of things, (3) travel and temporary additional duty costs for military and civilian personnel.

## MANAGEMENT STRUCTURE RDT & E



1961

SUPPORT BY OTHER BUREAUS OF MEDICAL DEPARTMENT RDT&E

Naval Radiological Defense Laboratory - Bureau of Ships

Total Budget	7,846,000
Biomedical Budget	800,000
Total Staff	558
Biomedical Staff	114

Provides administrative facilities, professional and technical support, instrumentation, nuclear sources, and special field test services.

Air Crew Equipment Laboratory - Bureau of Naval Weapons

Total Budget	1,002,000
Biomedical Budget	101,000
Total Staff	78
Biomedical Staff	38

Provides administrative facilities, professional and technical support, applied engineering research, instrumentation, special test services.

Aviation Medical Acceleration Laboratory - Bureau of Naval Weapons

Total Budget	645,000
Biomedical Budget	206,000
Total Staff	38
Biomedical Staff	37

Provides administrative facilities, professional and technical support, computer services, instrumentation, electronic and photographic services, engineering development and special test services.

Naval Missile Center - Bureau of Naval Weapons

Total Budget	10,500,000
Biomedical Budget	-0-
Total Staff	1866
Biomedical Staff	10

Provides administrative facilities, professional and technical support for missile research, space instrumentation, and housing for biomedical research facilities and personnel.

INTRAMURAL, EXTRAMURAL AND OVERSEAS FACILITIES

INTRAMURAL

Naval Medical Research Institute, Bethesda, Maryland  
Naval Medical Research Unit No. 1, Berkeley, California  
Naval Medical Research Unit No. 4, Great Lakes, Illinois  
Naval Medical Neuropsychiatric Research Unit, San Diego, California  
Naval Medical Research Laboratory, New London, Connecticut  
Naval Medical Field Research Laboratory, Camp Lejeune, North Carolina  
Naval Radiological Defense Laboratory, San Francisco, California  
Naval Toxicology Unit, Bethesda, Maryland  
Naval Medical School, Bethesda, Maryland  
Naval Dental School, Bethesda, Maryland  
School of Aviation Medicine, Pensacola, Florida  
Naval Unit, Ft. Detrick, Frederick, Maryland  
Aviation Medical Acceleration Laboratory, Johnsville, Pennsylvania  
Air Crew Equipment Laboratory, Philadelphia, Pennsylvania  
Naval Training Center, Great Lakes, Illinois  
Naval Training Center, San Diego, California  
Naval Academy, Annapolis, Maryland  
Armed Forces Radiobiology Research Institute, Bethesda, Maryland  
Medical Equipment Development Laboratory, Ft. Totten, New York  
Naval Hospital, Bethesda, Maryland  
Naval Hospital, Chelsea, Massachusetts  
Naval Hospital, Jacksonville, Florida  
Naval Hospital, Oakland, California  
Naval Hospital, Portsmouth, Virginia  
Naval Hospital, St. Albans, New York

EXTRAMURAL

Dr. William J. Mills, Jr., Anchorage, Alaska  
American Institute of Biological Sciences, Washington, D.C.  
Protein Foundation, Jamaica Plain, Massachusetts  
National Research Council, Washington, D.C. (2 contracts)  
University of California, Berkeley, California (3 contracts)  
University of Pennsylvania, Philadelphia, Pennsylvania

OVERSEAS

Naval Medical Research Unit No. 2, Taipei, Taiwan  
Naval Medical Research Unit No. 3, Cairo, Egypt  
Naval Medical Research Unit No. 3, Sub Unit, Malakal, Sudan  
Medical Science Liaison Unit, Gorgas Laboratories, Balboa Heights, Canal Zone

PERSONNEL RDT&E

Military

Medical Corps	65
Dental Corps	8
Medical Service Corps	98
Nurse Corps	1
Enlisted	<u>337</u>
	509

Civilian

Professional	273
Supporting	<u>358</u>
	<u>631</u>

Major Activities

	MC	Military				Civilian	
		DC	MSC	NC	Enl	Prof.	Sup.
Naval Medical Research Institute	16	3	25	94	86	28	
Naval Medical Research Unit No. 1	2	1	5	15			
Naval Medical Research Unit No. 2	3		6	11	6	74	
Naval Medical Research Unit No. 3	6	1	5	18	5	125	
Naval Medical Research Unit No. 4	4		4	27	7	15	
Naval Medical Neuropsychiatric Unit	1		2	8	9	11	
Naval Medical Field Research Laboratory	2	1	9	30	4	17	
Naval Medical Research Laboratory	9	1	7	30	39	18	
School of Aviation Medicine	5			23	22	14	
Naval Radiological Defense Laboratory	5		5	29	46	29	
Air Crew Equipment Laboratory	3		4	20	9	2	
Aviation Medical Acceleration Laboratory	4		4	8	13	8	
Naval Medical School	2		2	1		4	

Major Civilian Positions

Naval Medical Neuropsychiatric Unit -	Scientific Director - GS-15
Naval Radiological Defense Laboratory -	Radiology Biologist - GS-15
Naval Medical Research Institute -	Technical Director - PL-313
	Head, Parasitology Division - PL-313
	Head, Bio-Energetics Division - PL-313
	Head, Virology Division - PL-313
School of Aviation Medicine -	Supervisor Psychology - GS-15
	Head, Neurophysiology & Acoustics - PL-313
	Head, Biophysics Department - PL-313
	Physical Chemist - PL-313
Naval Medical Research Laboratory -	Scientific Director - PL-313
Naval Medical Research Unit No. 3 -	Supervisory Biologist - GS-15

"IN HOUSE" RESEARCH. . . STATEMENT BY DR. HAROLD BROWN

## "In House" Research Missions

Excerpts from a speech by Harold Brown, Director of Defense Research and Engineering, Department of Defense.

"I want to talk to you today about the place of in-house laboratories in getting research and engineering done in the Department of Defense. . . . It is therefore not surprising that the dividing line between in-house and contract research has not been clearly drawn in the past. For example, in 1955 it was suggested that--'where choice is possible, operations of research and development should be performed at the place in the Nation where they can be done most effectively and with greatest efficiency.' . . . It seems to me that there are about four very good and clear reasons for performing RDT&E within the Defense laboratories.

"First, the Defense laboratories should form a spearhead which must provide the Armed Forces with at least two essential services. (a) They must continuously investigate rapidly changing fields of science and engineering to find materials, techniques, processes and ideas which may prove to have some as yet undetermined military value, (b) In the course of their investigations in the fields of advanced technology, the Defense scientists and engineers must bring the problems of the Armed Forces before the broad scientific and technical community expressed in the terms of technical discourse.

"Second, we require objective scientific and engineering advice on contract research and development programs. The advice of the Defense laboratories is critical not only because advice which is sensitive to the Government's interests generally must be available to management, but because that advice must be particularly sensitive to the needs of the military users.

"Third, we need the laboratory organization to manage or help manage weapons system development and test programs.

"Fourth, we need the in-house laboratories as an essential part of the system of technical education for military officers. We recognize that without the actual experience of working in the laboratory it will not be possible to develop the cadres of technically proficient officers required for the operation of modern, rapidly changing armed forces and for understanding needed to set military requirements in a military situation in many ways unrelated to any previous one."

RESEARCH ACTIVITIES UNDER THE MANAGEMENT CONTROL OF  
THE RESEARCH DIVISION, BUREAU OF MEDICINE AND SURGERY

Naval Medical Research Institute

Location: National Naval Medical Center, Bethesda, Maryland

History : The Naval Medical Research Institute was established on 28 October 1942.

Mission : The Institute conducts basic and applied research and development that relate to health, safety and efficiency of naval personnel.

Command Relationship: An activity of the Potomac River Naval Command; a subordinate command of the National Naval Medical Center. Management, technical and coordination control are assigned the Bureau of Medicine and Surgery, Department of the Navy.

Personnel:

<u>Military</u>	Officers	44	Enlisted	94
<u>Civilian</u>	Graded	86	Ungraded	28

Budget:

FY 1959	FY 1960	FY 1961	FY 1962	FY 1963
1,322,000	1,291,250	1,364,945	1,360,700	1,480,000

Scientific Divisions:

Aviation Medicine	Chemistry	Pharmacology and Radiobiology
Bacteriology	Dental	Physical Biochemistry
Bio-Energetics	Parasitology	Physiology
Bio-Physics	Pathology	Radiation Technology
		Virology

Special Facilities:

Low-pressure chamber  
Adult Human Gradient Calorimeter  
High-amplitude vertical vibration machine  
Compression-recompression chamber (large, combination dry-wet, air conditioned)  
Compression chamber (standard, dry)  
1.25 MEV Cobalt Gamma-Ray Irradiator and Radiation Exposure Measurement facilities  
2-MEV Van de Graaff generator  
Color translating ultraviolet microscope  
Animal Laboratories - Breed and supply mice, rats, guinea pigs, and rabbits. Maintain dogs, cat and sheep colonies.



U. S. Naval Medical Research Institute  
Bethesda, Maryland

The Naval Medical Research Institute (NMRI) is staffed by a group of military and civilian scientists who provide a basic and applied research competence in biomedical areas directly related to military requirements and operational needs. It provides a source of scientific advisers and consultants readily available to the operational commands. NMRI provides support to the field laboratories, naval hospitals, and activities on problems beyond the local research capabilities. NMRI maintains a program of fundamental research in areas of military importance to develop skills and knowledge in anticipation of future problems. It provides a scientific potential for the application of military knowledge to new operational situations and demands.

Naval School of Aviation Medicine

Location: U. S. Naval Aviation Medical Center, Pensacola, Florida

History : The School of Aviation Medicine was founded in 1939. Formal research began in July 1940 when scientists, under joint Navy and National Research Council sponsorship, began investigations on methods of pilot selection. The present research laboratory opened in January 1943.

Mission : The mission of the school is to prosecute research on approved projects in aviation medicine and allied sciences.

Command Relationship: This activity is an independent command. It is under the military control of the Commanding Officer, U. S. Naval Aviation Medical Center, and the management and technical control of the Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	<u>27</u>	Enlisted	<u>2</u>
<u>Civilian</u>	Graded	<u>22</u>	Ungraded	<u>0</u>

Budget:

<u>FY 1959</u>	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>
451,500	371,000	390,388	420,230	413,000

Scientific Divisions:

Biochemistry	Cardiology	Physical Chemistry
Biometrics	Medical Electronics	Physiology
Biophysics	Neurophysiology and Acoustics	Psychophysiology

Special Facilities:

Low-pressure chambers  
Basic biochemical laboratory  
Basic physiological laboratory  
Experimental Animal irradiation laboratory  
Aviation psychology laboratory, including IBM unit  
and statistical facilities  
Spectroscopic laboratory  
Electromicroscopy

Naval School of Aviation Medicine

Continued

Special Facilities: (Continued)

Nuclear emulsion laboratory (equipped for processing and track evaluation of extremely thick emulsions)  
Low-level alpha radiation laboratory (equipped with low-level alpha counter and pulse ionization chambers)  
Medical electronics laboratory  
Electrocardiography laboratory  
Vectorcardiography laboratory  
Ballistocardiography laboratory  
Bioacoustics laboratory (equipped for studies in voice communications, high-intensity noise, audiology, and psychoacoustics)  
Electrophysiological laboratory (equipped for electroencephalography, EEG, airborne EEG, electromyography, EMG, and experimental neurophysiology, neurohistology, and animal surgery)  
Slow Rotation Room  
Human Disorientation Device



U. S. Naval School of Aviation Medicine  
Pensacola, Florida

The School of Aviation Medicine is staffed and equipped to provide basic and applied research capabilities in the fields of biology, psychology and medicine as they apply to the solution of operational problems in Naval aviation. These include stress due to angular acceleration, high altitude operations and high-intensity noise, physical standards for aviation personnel, problems in aviation safety, escape and rescue, psychology and human engineering, training methods, re-education and career performance of aviation personnel.

U. S. Navy Medical Neuropsychiatric Research Unit

Location: On the compound of Naval Electronics Laboratory, San Diego 52, California

History: By SECNAV NOTICE 5450 of 8 May 1959, the U. S. Naval Medical Neuropsychiatric Research Unit, San Diego, was established effective 1 June 1959.

Mission: The mission of the activity is: To conduct research in the area of neuropsychiatry as it applies to the Naval Service.

Command Relationship: The activity is a component of the U. S. Naval Base, San Diego, California. It is under the military command of the Commander, U. S. Naval Base, San Diego, California, unless otherwise directed by the Chief of Naval Operations, and under the management and technical control of the Chief, Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	3	Enlisted	8
<u>Civilian</u>	Graded	19	Ungraded	1

Budget:

<u>FY 1959</u>	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>
-	75,000	156,300	186,000	195,000

Scientific Divisions:

Assessment of Psychiatric Effectiveness of Naval Personnel  
Development of Diagnostic and Psychotherapeutic Techniques for use in the Naval Service  
Development of Preventive Psychiatry Programs  
Neurology  
Psychopharmacology

Special Facilities:

Flicker Fusion Apparatus  
Controlled populations in the MCRD, Naval Training Center, Camp Pendleton and others.  
Medical support U. S. Naval Hospitals and Marine Corps Dispensaries.

Naval Medical Research Unit No. 1 (NMRU-1)

Location: University of California, Berkeley 4, California

History: In June of 1943 the Naval Laboratory Research Unit One was disestablished. Naval Medical Research Unit Number One was commissioned on 17 January 1944.

Mission: The mission of the unit is to (1) conduct medical research in airborne infectious diseases, (2) conduct research on the physiology of cold weather stress, and (3) participate in such portions of the NBL classified investigations as may be considered by the Commanding Officer of the unit to be in the interests of the Bureau of Medicine and Surgery.

Command Relationship: The Naval Medical Research Unit Number One is under the military command of the Commandant, Twelfth Naval District, and management and technical control of the Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	8	Enlisted	15
<u>Civilian</u> (Univ. contract)	Graded	0	Ungraded	0

Budget:

<u>FY 1959</u>	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>
32,000	39,000	46,000	36,000	50,000

Affiliation and Liaison with other Agencies: NMRU-1 is operated jointly with the Naval Biological Laboratory, Naval Supply Center, Oakland, California, and the University of California, Berkeley 4, California. Personnel are assigned to the Naval Biological Laboratory as participating scientists and supporting technicians.



U. S. Naval Medical Research Unit No. 1  
Berkeley, California

The U. S. Naval Medical Research Unit No. 1 performs research and collaborates with the Naval Biological Laboratory in fundamental studies on host parasite relationships, the airborne spread of infection, and organism characteristics. It provides a nucleus of personnel trained in current techniques, rapid identification of organisms and the preventive and protective countermeasures available against biological warfare.

Naval Medical Research Unit No. 2

Location: Taipei, Taiwan

History: Naval Medical Research Unit No. 2, the "Rockefeller Institute Unit," was established on Guam in World War II. It was deactivated in 1946 and re-established on Taiwan by the Secretary of the Navy on 9 May 1955, as a joint effort with the Chinese Nationalist government.

Mission: The mission of the unit is to provide medical research, essential information on diseases and medical problems of military significance, and the biological knowledge required for controlling the animal and insect disease vectors of the Far East.

Command Relationship: Naval Medical Research Unit No. 2 is a shore activity assigned to the Operating Forces of the Navy. It is under the military command of the Taiwan Defense Command, unless otherwise directed by the Chief of Naval Operations, and under the management control of the Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	9	Enlisted	11
<u>Civilian</u>	Graded	6	Ungraded	74

Budget:

<u>FY 1959</u>	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>
152,118	120,000	146,400	172,000	204,000

Scientific Divisions:

Tissue culture	Clinical
Pathology	Entomology
Biochemistry	Helminthology
Protozoology	Bacteriology
Medical zoology	Virology
X-ray, EMR, ECG	Media and sterilization

Special Facilities:

The Naval Medical Research Unit No. 2 is in a unique position to study disease endemic and epidemic in Taiwan and the Far East. Its relationship with civilian and military organizations provides support in a broad field of endeavor which is effectively producing medical information on diseases of this less known area of the world.

U. S. Naval Medical Research Unit No. 2  
Taipei, Taiwan

The mission of the U. S. Naval Medical Research Unit No. 2 (NAMRU-2), Taipei, Taiwan, is to study the endemic and epidemic diseases of Taiwan and the Far East. It has provided research and clinical assistance in various epidemics, and has developed and, in part, evaluated practical methods of cholera and trachoma control. This laboratory provides medical information essential to operational planning.

Naval Medical Research Unit No. 3

Location: Cairo, Egypt

History: Naval Medical Research Unit No. 3 was established by the Secretary of the Navy on 15 January 1946 in collaboration with the government of Egypt.

Mission: The mission of the unit is to perform medical research on diseases of military importance endemic and epidemic in the near East. These include infectious hepatitis, typhoid fever, paratyphoid fever, typhus fever, relapsing fever, Malta fever, plague, bilharziasis (schistosomiasis), bacillary dysenteries and virus diseases. Research is also conducted on dental problems.

Command Relationship: Naval Medical Research Unit No. 3 is under the military control of the Commander-in-Chief, United States Naval Forces, Eastern Atlantic and Mediterranean, London, England, and the management control of the Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	12	Enlisted	18
<u>Civilian</u>	Graded	129	Ungraded	0

Budget:

FY 1959	FY 1960	FY 1961	FY 1962	FY 1963
265,000	297,000	363,600	400,000	373,000

Scientific Divisions:

Tissue culture	Clinical
Dentistry	Cardiopulmonary
Pathology	Entomology
Biochemistry	Helminthology
Protozoology	Bacteriology
Medical zoology	Virology

Special Facilities:

The unit obtains patients from the 2000 Bed Abbassia Fever Hospital, and the 1000-bed Embaba Government hospital. It maintains facilities equipped to do medical research at the level of the best medical institutions and laboratories in the United States. The laboratory operates a sub-unit at Malakal in the southern Sudan for the study of Kala-azar and other diseases endemic in that area.



U. S. Naval Medical Research Unit No. 3  
Cairo, U.A.R.

U. S. Naval Medical Research Unit No. 3, Cairo, U.A.R., is located adjacent to Egyptian Infectious Disease hospitals which provide patients for the clinical study of the endemic and epidemic diseases of the Near East. This laboratory provides a unique opportunity to study brucellosis, trachoma, amebiasis, schistosomiasis, typhoid, arthropod born viral diseases, non specific enteric infections and problems of nutrition. This Unit has placed research task groups on the Arabian Peninsula and in Northern and Eastern Africa. The Sub-unit at Malakal in southern Sudan is conducting research on the epidemiology of Kala-Azar.

Naval Medical Research Unit No. 4

Location: U. S. Naval Hospital, Great Lakes, Illinois

History: Naval Medical Research Unit No. 4 was established 1 June 1946 at the U. S. Naval Hospital, Dublin, Georgia, for research on rheumatic fever. On 14 June 1948 the unit was transferred to the U. S. Naval Training Center, Great Lakes, Ill. On 14 June 1961, Naval Medical Research Unit No. 4 was relocated to Buildings 1-H and 43-H of the U. S. Naval Hospital, Great Lakes, Illinois.

Mission: The primary mission of the research unit is to develop effective means for the control of the acute communicable respiratory diseases among military personnel and to conduct studies on the etiology and pathogenesis of rheumatic fever with the objective of developing an effective prophylaxis for this disease. It also serves as a liaison agency for other groups performing research studies involving Navy recruits and as a Navy diagnostic center for streptococcal infections and influenza.

Command Relationship: Naval Medical Research Unit No. 4 is an activity under the military control of the Commanding Officer, U. S. Naval Hospital, Great Lakes, Illinois, and under the management and technical control of the Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	6	Enlisted	27
<u>Civilian</u>	Graded	17	Ungraded	5

Budget:

<u>FY 1959</u>	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>
198,000	200,000	259,700	297,122	314,000

Scientific Divisions:

Bacteriology	Clinical and Epidemiological
Biochemistry	Immunology
Biometrics	Virology

Special Facilities:

The Naval Medical Research Unit No. 4 is located at the Naval Training Center, Great Lakes where a large controlled population can be studied. A field laboratory is maintained in the troop infirmary. Special photo-fluorographic units are located in two recruit dispensaries. Data processing is provided by the cooperative use of IBM machines at the U. S. Naval Hospital and at the Unit.

U. S. Naval Medical Research Unit No. 4  
Great Lakes, Illinois

The U. S. Naval Medical Research Unit No. 4, situated at the Naval Training Center, Great Lakes, Illinois, provides a unique opportunity to study respiratory disease as it occurs in a large recruit training activity. The high incidence of respiratory infection provides unlimited clinical material for study, and the controlled population provides an exceptional opportunity to evaluate control and preventive procedures.

Naval Medical Research Laboratory

Location: U. S. Naval Submarine Base (New London) Groton, Connecticut

History: The Laboratory was established as a naval activity on 25 June 1946. From 1941 to 1946 Submarine Medicine research was accomplished by a Medical Research Department of the Base.

Mission: To conduct medical research and development on problems peculiar to shipboard, submarine, and diving medicine.

Command Relationship: The Naval Medical Research Laboratory is an activity of the U. S. Naval Submarine Base. Military command is exercised by the Commanding Officer of the Base. Management, financial, and technical control is exercised by the Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	17	Enlisted	30
<u>Civilian</u>	Graded	61	Ungraded	6

Budget:

<u>FY 1959</u>	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>
\$465,000	\$465,000	\$480,000	\$545,000	\$605,000

Scientific Divisions:

Auditory  
Dental  
Human Factors Engineering  
Personnel Assessment  
Physiology  
Vision

Special Facilities:

Temperature, Humidity, and Pressure Chambers  
Complete Optical Media Testing Facility  
Anechoic Chambers (840 sq. ft) (297 sq. ft)  
High Intensity Noise Chamber (473 sq. ft.)  
Small-Group Observation Laboratory  
Experimental Dark Rooms  
Radio-isotope Laboratory  
Vision Alleys and Testing Areas  
Noise Survey Equipment



U. S. Naval Medical Research Laboratory  
New London, Connecticut

The staff and facilities at the Naval Medical Research Laboratory have been developed to provide a capability for conducting basic and applied physiological and psychological research germane to submarine medicine. The location of the Laboratory in the New London area provides many unique research opportunities. Officers and enlisted men entering the submarine service attend the Submarine School at New London. This circumstance provides an unlimited source of subjects for the study of physical and psychological assessment methods and techniques. The 100-foot submarine escape training tank is used for investigations in underwater physiology. The proximity of the Laboratory to the operating forces and a large submarine building yard has established exceptional two-way communications between the suppliers and users of technical information.

U. S. Naval Hospital  
Chelsea, Mass.

Location: U. S. Naval Hospital, Chelsea, Massachusetts

History: In June of 1956, the Department of Defense requested that a laboratory be established at the U. S. Naval Hospital, Chelsea, to investigate the glycerol-freezing method for long-term preservation of red blood cells. Funds were made available and Protein Foundation's existing red cell preservation contract with the Navy was expanded to implement this study.

Mission: The mission of the laboratory is to conduct research in methods for the long-term preservation of blood and the investigation of its clinical usefulness in a service hospital.

Command Relationship: The Blood Preservation Research Laboratory is under the administrative control of the Commanding Officer, U. S. Naval Hospital, Chelsea.

Personnel:

Military	Officers <u>3</u>	Enlisted <u>2</u>
Civilian	Graded _____	Ungraded <u>1</u>

Budget:

FY 1959	FY 1960	FY 1961	FY 1962	FY 1963
32,627	15,450	39,950	25,000	35,000

Scientific Divisions:

Clinical  
Laboratory  
Surgery  
Medical

Special Facilities:

- (a) In Blood Preservation Laboratory
- 1 Cohn Blood Fractionator with 22 cartridges
  - 1 Special Autoclave
  - 1 Recording Thermometer
  - 1 Still (For pyrogen free distilled water)
  - 3 Deep Freeze Units (minus 80-120 degrees centigrade)

- (b) In Radioisotope Laboratory of Hospital
- 1 3 x 3 inch Scintillation Well Counter with Spectrometer
  - 1 Warburg Apparatus (refrigerated) (on order)

U. S. Navy Toxicology Unit

Location: National Naval Medical Center, Bethesda, Maryland

History : Navy Toxicology Unit was established by the Secretary of the Navy on 1 January 1959, as a component command of the National Naval Medical Center, Bethesda, Maryland

Mission: The mission of the Unit as stated by the Secretary of the Navy is to "provide technical and specialized services in the fields of operational toxicology and health engineering as related to toxicity problems encountered aboard ships; and in the design and use of new weapon systems. Also, develop and provide biological data necessary for determining permissible limits so that precautionary measures, conducive to good health practice, may be prescribed."

Command Relationship: Navy Toxicology Unit is under the military command of the Commanding Officer, National Naval Medical Center, and under the management control of the Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	<u>4</u>	Enlisted	<u>10</u>
<u>Civilian</u>	Graded	<u>1</u>	Ungraded	<u>2</u>

Budget:

<u>FY 1959</u>	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>
-	39,950	42,000	40,000	40,000

Scientific Activities: These deal with the biological effects of acute and chronic exposure within the closed environment.

Special Facilities: Eleven exposure chambers, designed for continuous inhalation studies, are in operation. Six (6) of these are of special design Rochester type units. This equipment can generate controlled and reproducible mists, gas mixtures, dusts or combinations of these contaminants. The particle size is controlled by impactors; and air samples can be taken at will.



U. S. Navy Toxicology Unit  
Bethesda, Maryland

The U. S. Navy Toxicology Unit contains the finest and most modern equipment available for the specific study of toxicity levels within a closed environment. The success of the nuclear submarines reflects the immediate and effective response of this laboratory to the innumerable problems of aerosols, odors and toxic gases in the World of the Submarine.

Naval Medical Field Research Laboratory

Location: Marine Corps Base, Camp Lejeune, North Carolina

History : This laboratory was established in August 1943 by joint agreement between the Commandant, Marine Corps, and Chief, Bureau of Medicine and Surgery, Department of the Navy, to study problems peculiar to the Marine Corps at a research laboratory operating in close liaison with field troops.

Mission : The mission is to conduct basic research, applied research, development and testing in the dental, medical and applied sciences, with emphasis on the special problems of amphibious and field medicine.

Command Relationship: The laboratory, established under a Commanding Officer, is assigned to the Military Command of the Commanding General, Marine Corps Base, Camp Lejeune. It is under coordination control of the Commandant of the Fifth Naval District and management control of the Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	<u>12</u>	Enlisted	<u>30</u>
<u>Civilian</u>	Graded	<u>20</u>	Ungraded	<u>1</u>

Budget:

<u>FY 1959</u>	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>
72,500	83,850	105,000	105,000	166,000

Scientific Divisions:

Microbiology	Personnel Protection,
Pharmacology and Physiology	Body Armor and Wound Ballistics
Entomology and Field Sanitation	Biochemistry
Psychology	

Special Facilities:

Climatic chamber - 25 cu. ft. Temperature range - from  $-80^{\circ}$  to  $180^{\circ}$  F.  
Pressure control - to simulate altitudes of from 0 to 50,000 ft.  
Equipment-testing laboratory  
Indoor ballistic test range  
Tailoring facility for fabricating experimental armored and load carrying-garments  
Fabric, woodworking and metal shops  
Engineering division  
Missile-velocity measuring devices



U. S. Naval Medical Field Research Laboratory  
Camp Lejeune, North Carolina

This laboratory is an integral part of the U. S. Marine Corps Amphibious Training Command and provides research support to The Base Command and the Second Marine Division. Its mission relates to the broad problems of amphibious and field operations, evacuation techniques, medical equipment, personnel protective garments, preventive medicine and thermal stress.

RESEARCH LABORATORIES WITH MEDICAL SECTIONS  
UNDER THE ADMINISTRATIVE CONTROL OF OTHER  
BUREAUS DEPARTMENT OF THE NAVY

## Naval Radiological Defense Laboratory

Location: U. S. Naval Shipyard, San Francisco, California

History: The NRDL was formally designated as such in 1948, after an outgrowth from a small radiological safety group formed in 1946 for decontamination of target ships returned to San Francisco Naval Shipyards from Operation Crossroads at Bikini Atoll. It has grown from an initial 5-man group to its present about 600-man group, representing almost every field of science and engineering, and from its original temporary quarters to present facilities including a 6-story laboratory building, an accelerator building, breeding and holding building, various storage buildings, and occupancy of buildings and land areas at CAMP PARKS across the Bay from San Francisco.

Mission: (in brief) To conduct basic and applied research on nuclear and thermal radiation from all nuclear sources, including accidents and incidents, including the study of chemical, physical and biological processes and effects (including dispersion and contamination studies); to develop and evaluate radiac devices and equipment, shielding materials and equipment, medical countermeasures for the biological effects, reclamation and decontamination procedures; to conduct interrelated effects composite evaluations; to prepare data for technical publications and training manuals; to develop techniques for radioisotope use.

Command Relationship: Under military command of the Commanding Officer, U.S. Naval Base, San Francisco, California; and under management control of the Bureau of Ships.

Personnel: (Biomedical)

<u>Military</u>	<u>Officers</u>	10	<u>Enlisted</u>	29
Civilian	Graded	60	Ungraded	0

Budget:

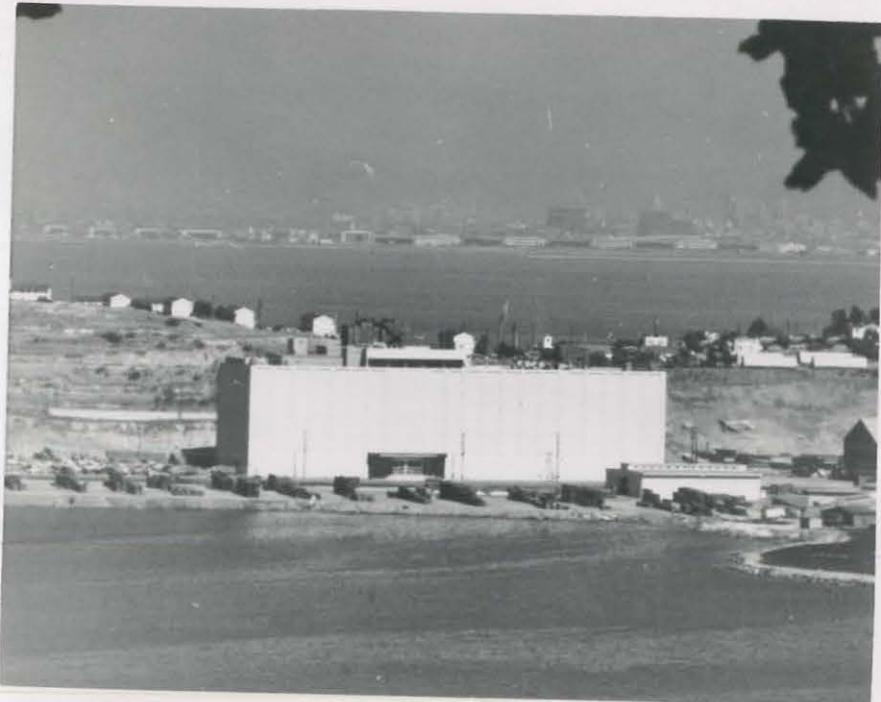
<u>FY 1959</u>	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>
\$483,000	500,000	800,000	800,000	800,000

Scientific Divisions: (in brief)

Biological and Medical Sciences Division with 5 branches  
Chemical Technology Division with 4 branches  
Nucleonics Division with 5 branches  
Military Evaluations Division with 4 branches  
Medical Department

Special Facilities: (in brief)

Engineering Scale Radioactivity Handling Facilities  
Experimental Animal Facilities  
Field Test Equipment and Instrumentation Facilities  
Hydrodynamic and Radiological Underwater Explosion Test  
Facilities and Equipment  
Nuclear Radiation Sources and Environmental Facilities  
Cobalt 60 (1000 curies)  
Neutron Generator  
Van de Graaff Accelerator (2 MEV)  
X-Ray Irradiation facilities  
Shielding range and moving source facilities  
Precision Nuclear Radiation Measurement Facilities and  
Instrumentation  
Charged Particle scattering chamber  
Controlled low background room  
Programming counter (Baird Atomics Incorporated,  
Modified Model 750)  
Electron Paramagnetic Resonance Spectrometer  
Liquid scintillation counters  
Multichannel pulse height analyzers  
Magnetic beta spectrometer  
Radiac Instrument Development and Testing Facilities  
Thermal Radiation Facilities and Equipment  
Various Special Facilities and Equipment  
Use of CAMP PARKS in Alameda County for engineering  
scale field tests; large animal experimental work;  
fallout shelter program  
Breeding and holding facility for small animals  
Electron microscopes  
Digital computer  
Chromatographic equipment  
Various spectrometers, spectrophotometers, spectrographs



Naval Radiological Defense Laboratory  
San Francisco, California

The Naval Radiological Defense Laboratory in the accomplishment of the mission assigned conducts basic and applied research as follows; (1) Determines characteristics of thermal and nuclear radiation wherever and whenever occurring and of all radioactive materials, (2) Determines biological effects of thermal and nuclear radiation, (3) Determines effects of thermal and nuclear radiation on materials, components, and systems, and (4) Assesses hazards of nuclear warfare, and those arising from the peacetime use of nuclear energy, and nuclear accidents and incidents. This shall be interpreted as encompassing all aspects up to the provision of prototype equipments.

Bio Sciences Office, Pacific Missile Range  
and  
Life Sciences Department of Naval Missile Center

Location: Point Mugu, California

History: The Bio Science Office was established in February 1959 and the Life Sciences Department was established in October 1959.

Mission: To analyze and coordinate ground support requirements of range users for bio sciences and medical facilities in missile and space vehicle programs. To plan and administer a program of R&D in support of Naval weapons systems, Naval aeronautics, range operational requirements and other National requirements.

Command Relationship: Commander, Pacific Missile Range. Management, technical and coordination control rest with the Bureau of Naval Weapons. The Bureau of Medicine & Surgery advises on the life sciences research program.

Personnel:

<u>Military</u>	Officers	<u>7</u>	Enlisted	<u>11</u>
<u>Civilian</u>	Graded	<u>13</u>	Ungraded	<u>None</u>

Budget: Funds provided by BUWEPS through general support of the Pacific Missile Range and Foundation Research. No specific budgeting of funds has occurred.

Scientific Divisions -

Bio-Medical  
Bio-Engineering  
Bio-Environmental

Special Facilities -

Vibration  
Acceleration  
Acoustic  
Altitude/temperature/humidity  
Climatic/temperature/humidity  
Auxiliary pickup display and recording instrumentation  
Simulated test capsules  
Monitoring consoles  
Low pressure chamber

8

Aviation Medical Acceleration Laboratory

Location: Naval Air Development Center, Johnsville, Pennsylvania

History: Design planning for human centrifuge began in 1944. Construction was completed and the Aviation Medical Acceleration Laboratory was established in 1952.

Mission: The Laboratory conducts research in the biological and physical effects of accelerative forces as developed in various operational situations and develops, improves and evaluates aviation personal equipment for protection against accelerative forces.

Command Relationship: Under military command of Commander, Naval Air Development Center. Management and technical control rest with the Bureau of Naval Weapons. Technical direction of the research program in aviation medicine rests with the Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	9	Enlisted	1
<u>Civilian</u>	Graded	21	Ungraded	0

Budget:

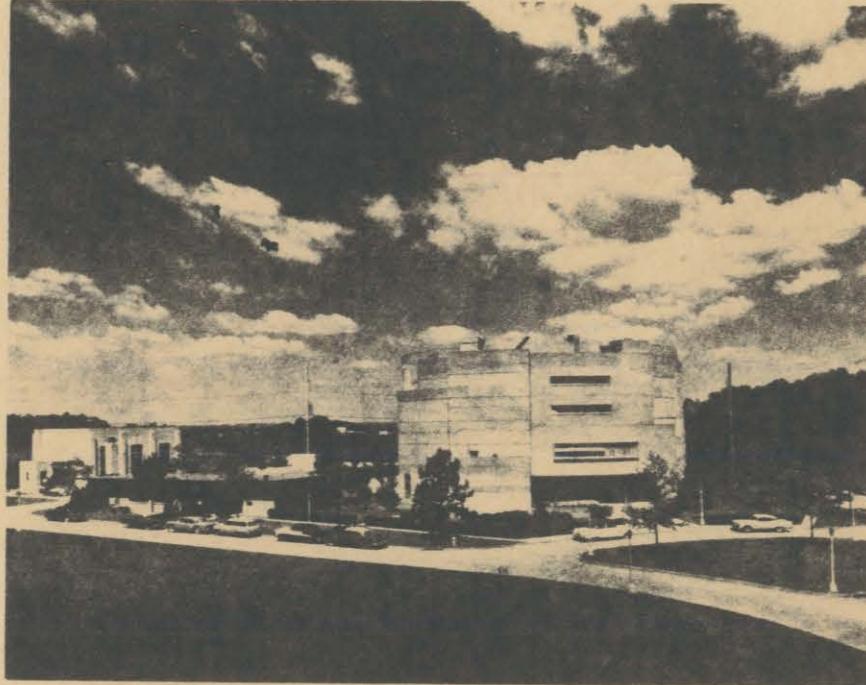
FY 1959 \$212,000	FY 1960 \$198,000	FY 1961 \$210,500	FY 1962 \$206,000	FY 1963 \$240,000
----------------------	----------------------	----------------------	----------------------	----------------------

Scientific Divisions -

Physiology	Pathology
Psychology	Biophysics and Bioastronautics
Biochemistry	Engineering

Special Facilities -

Human centrifuge with 4,000 hp motor and 50-foot arm  
Access to Aeronautical Computer Laboratory for computer control of centrifuge  
Animal laboratories



Aviation Medical Acceleration Laboratory  
Johnsville, Pennsylvania

The Aviation Medical Acceleration Laboratory consists of the largest human centrifuge in existence with associated research divisions in physiology, biochemistry, biophysics, psychology, human engineering and an animal facility. This Laboratory has conducted the major portion of acceleration research performed on humans in connection with conventional military aircraft, the X-15, Dyna-Soar programs and Project Mercury.

### Air Crew Equipment Laboratory

Location: Naval Air Material Center, Philadelphia, Pennsylvania

History: The Air Crew Equipment Laboratory under various names has existed since January 1942 when it was organized for the evaluation of oxygen equipment and flight clothing.

Mission: Conducts basic and applied research in biological, psychological and human engineering aspects of aviation medicine pertaining to personal and safety equipment of naval aircrews and their ability to perform under the stress of operational conditions. Conducts applied engineering RDT&E of personal and safety equipment to insure total bioengineering integration of the equipments.

Command Relationship: The Air Crew Equipment Laboratory is under the command of the Naval Air Material Center and the management and technical control of the Bureau of Naval Weapons. The aviation medical research program is under the technical direction of the Bureau of Medicine and Surgery.

Personnel:

<u>Military</u>	Officers	7	Enlisted	20
<u>Civilian</u>	Graded	9	Ungraded	2

Budget:

<u>FY 1959</u>	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>
104,000	100,000	105,000	101,000	135,000

Scientific Divisions:

Respiratory  
Human Engineering  
Environmental Stress

Special Facilities:

Three personnel type altitude chambers  
Bio-astronautics Test Facility which permits confinement and isolation studies  
Ejection Seat Test Tower  
Linear accelerator, hydro-pneumatically operated  
Underwater Test Facility  
Four equipment altitude chambers  
Flexible Cockpit Test Device  
Complete liquid oxygen laboratory  
Escape System Recovery Net capable of recovering ejected free flight seats and capsules  
Vertical Accelerator for equipment evaluation  
Ejection Seat and Components Environmental Simulator  
Personnel Cold Chamber  
Weather Room  
Electrostatic shielded enclosure  
Acoustic chamber

Air Crew Equipment Laboratory  
Philadelphia, Pennsylvania

The Air Crew Equipment Laboratory is equipped to utilize physiological, psychological and human engineering knowledge in the design, construction, testing and evaluation of personnel and safety equipment for use in the fleet. It has special competence in the areas of oxygen equipment, aviation pressure suits, immersion suits, escape equipment and procedures, and the human aspects of cockpit arrangements. Unique equipment exists for the conduct of integrated life support systems research and isolation studies.

PROGRAM BRIEFS

## CHOLERA

The epidemics of cholera that have occurred in southeast Asia in recent years have provided opportunities to re-examine the epidemiology, physiology, pathology and therapy of this disease. The presence of the cholera vibrio in the environment or even in the human host does not necessarily result in disease. Recent studies on pathology of cholera in Thailand have shown that the intestinal mucosa is not denuded and the histological changes observed in the intestinal lining are similar to those seen in nutritional deficient states. Studies by the U.S. Naval Medical Research Unit No. 2, Taiwan, have demonstrated that acidosis and a loss of 20 to 30 per cent of the body stores of potassium ion occurs with the severe dehydration of cholera. A practical and highly effective treatment has been developed emphasizing rehydration and electrolyte replacement. The clinical use of this regimen is feasible. Knowledge of the biology and ecology of the cholera vibrio is incomplete, and the pathogenic and epidemic characteristics of the "El Tor" strain must be clarified. The efficacy of cholera vaccine has not been established; research on the antigenic composition of current cholera strains and longitudinal studies on immunization schedules are priority requirements.

### COLD INJURY

The importance of cold injury in winter military operations has been dramatically demonstrated during the Napoleonic, German-Russian and Korean campaigns. The Research Division is supporting clinical research in Alaska on the treatment of cold injury. It has been shown that rapid rewarming and physiotherapy are superior to all other treatment regimes in reducing complications, tissue loss and the degree of permanent disability. Physiologic changes resulting from cold injury are also under study at the U. S. Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland.

Research projects to develop clothing for the prevention of cold injury are conducted by the Bureau of Supplies and Accounts, Navy Department.

A cold injury problem, sometimes referred to as "frozen lung," has been identified in Antarctica. The signs and symptoms are apparently an acute response of the bronchopulmonary tree to extremely cold air, and results in hemoptysis which may be of sufficient severity to produce a significant anemia. The etiology and pathology of this injury requires further study.

### DISORIENTATION AND ANGULAR ACCELERATION

The effects of angular acceleration on the physiological functioning of pilots of high performance aircraft and manned space vehicles impose a serious biological limitation on the success of these operations. These effects may be (a) the appearance of spatial disorientation, (b) interference with visual monitoring processes, (c) loss of efficiency in performing operational tasks, or (d) actual incapacitating acceleration sickness. Combinations of vehicle maneuvers and passenger head movements result in simultaneous rotation about two or more mutually orthogonal axes, providing stimulation of the semi-circular canals in more than one axis, thus differing radically from normal experience. Various elements of these complex accelerations have been studied by the U. S. Naval School of Aviation Medicine, at Pensacola, Florida, and at the Aviation Medical Acceleration Laboratory, by exposing subjects to a constant angular velocity environment for extended periods. It has been shown that, for relatively low angular velocities between 1.7 and 10 RPM, normal head movements can result in labyrinth-originated disturbances sufficient to cause nausea and vomiting. Although prolonged constant rotation within this range did not interfere with the subject's ability to perform a variety of tasks, the accompanying motion sickness may so seriously reduce the subject's capability that he is unable or unwilling to perform the tasks. The visual perception of horizontal and vertical in a rotating environment has also been studied. It is believed that the perceived horizontal is a function of visual and gravitational stimuli acting jointly, but the relative importance of each is not known. Results of studies indicate a gradual

change in the frame of reference from visual to gravitational during exposure to angular acceleration forces. However, all test subjects did not completely accept the gravitational frame of reference for reasons which are not clear. Of importance is the observation that there is considerable variation in the severity of the responses between subjects and that the subjects adapt to this environment after prolonged exposure and the visual illusions and disturbing vegetative reactions are substantially reduced.

Basic to the investigation of these problems is the need for a definitive and comprehensive description of the nonauditory functions of the vestibular apparatus, and specifically of the responses of the semicircular canals to angular acceleration. The development of research techniques and tools will continue to progress with these investigations. Space-flight simulating equipment is of major importance in the selection, training, and maintenance of pilots and astronauts.

### KALA-AZAR

Kala-azar occurs in various parts of the world, but is endemic and epidemic in vast areas of East and Central Africa. It presents major health and economic problems to the indigenous populations and to military forces operating in these areas. Epidemiological studies are exceptionally difficult to accomplish in this remote area characterized by a lack of transportation and minimal knowledge of the reservoirs and vectors of the protozoan parasite of this disease. The U. S. Naval Medical Research Unit No. THREE, at Cairo, Egypt, has established a field laboratory at Malakal, Republic of the Sudan, to investigate the epidemiology and ecology of Kala-azar in this highly endemic region. Preliminary study has indicated that new field research techniques must be developed to define the natural history of this disease as it occurs in Africa. Fluorescent antibody techniques have promise of value in field studies to determine insect vectors, incidence, seasonal periodicity, and the areas where infections are acquired. Clinical and therapeutic studies of the disease are in progress. The relation of nutrition and susceptibility to Kala-azar is under investigation. Immunological factors in infection require clarification to determine the possibility of altering host susceptibility by immuno-chemical methods.

## PNEUMONIA

The pneumonias are in many respects the most important of the acute respiratory diseases in military life. Acute Respiratory Disease and the Pneumonias are the major cause of hospitalization and time lost in recruit populations. Investigations in recent years have demonstrated that certain types of adenoviruses are responsible for a significant amount of acute respiratory disease in recruits and that vaccines containing appropriate antigens are highly effective in reducing admission rates from these diseases. Studies on the etiology of pneumonia have shown that the "Eaton" agent may cause epidemics of pneumonia in recruits and that this form of pneumonia responds clinically to treatment with a broad spectrum antibiotic. Evidence is accumulating which suggests that the "Eaton" agent is not a true virus. Attempts at controlling respiratory diseases through environmental hygienic measures have not been successful. Immunization of the susceptible host offers the best promise of preventing these diseases. Research on the etiology, epidemiology and prevention of the acute respiratory diseases and pneumonia will continue using advances in bacteriological, virological and immunological methods as they occur.

### TRACHOMA

The isolation of the trachoma virus and its growth in quantity in the yolk sac of chick embryos has provided new opportunities for the study of this important disease. Research by the U. S. Naval Medical Research Unit No. 2, Taiwan, has shown that there are at least four different serologic variants of the virus demonstrable by mouse toxicity neutralization tests. A formalin inactivated vaccine from purified elementary bodies of trachoma virus has been prepared and field trials of its effectiveness in preventing trachoma in Taiwan children are underway. No adverse effects from the vaccine have been observed; insufficient time has elapsed to provide an indication of its immunizing characteristics; good complement-fixing antibody responses to the vaccine have been observed. A complement-fixation test has been developed using a purified trachoma virus antigen, which promises to be of value in the laboratory diagnosis of this disease. Further studies have been approved and may be conducted with the assistance of a team from the World Health Organization.

### BLOOD PRESERVATION

The logistical problems of providing adequate amounts of human blood for the treatment of casualties resulting from natural disasters or military operations has stimulated efforts to develop methods for the long-term storage of blood and blood derivatives. Procedures have been developed which permit the storage of blood for indefinite periods. The studies carried out at the U. S. Naval Hospital, Chelsea, Massachusetts, in cooperation with Protein Foundation have shown that glycerolized red cells may be stored at -80°C for as long as 44 months. After thawing, deglycerolization and suspension in plasma or serum albumin, the reconstituted blood may be used in the same manner as fresh whole blood. This procedure permits (a) stockpiling of human blood, (b) the storage of rare type bloods, (c) storage of blood for autotransfusion. The equipment required in processing blood for long-term storage is relatively simple and the entire procedure can be accomplished within one hour. A completely automated process has been developed and successfully tested. The advantages of frozen blood relate to immediate availability, minimal loss in processing and reissue, minimal reactions, and the ability to adjust the clinical characteristics of the blood to the patient's individual needs. The method gives promise of preventing the transmission of Homologous Serum Jaundice.

## U. S. NAVY NEUROPSYCHIATRY

The administration and supervision of the Navy Medical Department program in neuropsychiatry constitutes one of the most challenging and difficult tasks in military medicine. As the techniques of modern warfare become increasingly complex, placing a premium upon the technical abilities of all concerned, the human emotional factors continue to represent the single, largest medical problem in accession, training, and attrition for the military service. Without an adequate psychiatric assessment and screening program, and appropriate elimination from the service, inadequate or marginal individuals would further contribute to the expense and loss of man power as a result of their own ineffectiveness and also would involve large numbers of line, medical, investigative, disciplinary and custodial personnel in caring for the variety of symptomatology and acts characterizing their inadequacies or maladjustment to the stresses of military life.

Specifically, during the year 1960, 4,818 members or 42 per cent of all medical separations from the naval service were for neuropsychiatric reasons. In addition, during the same period of time, 5,522 personnel were discharged from the naval service through the auspices of the Aptitude Boards and the Navy and Marine Corps recruit training Neuropsychiatric Units. These 10,340 individuals were processed by 103 psychiatrists, 20 neurologists, and 20 clinical psychologists.

In addition, a conservative total of professional consultations within the hospital setting during this same period of time equalled 100,000; the newly implemented corrective services program required 17 additional neuropsychiatric facilities; 83 per cent of all disciplinary discharges required a prior complete neuropsychiatric examination; all prospective members for Antarctic duty, submarine duty, nuclear power school, and under water demolition assignment required a complete psychiatric and psychologic appraisal; and all cases affiliated with the Navy in classified matters must receive a psychiatric assessment prior to gaining their security clearance. With this expansion of psychiatric services rendered to the Naval Establishment, a concurrent demand has arisen for substantial increases in the training of both line and medical personnel to assist in the administration of the Navy psychiatric program.

The success of the Neuropsychiatric program depends in a large measure upon the accuracy and immediacy of a simultaneous NP research program. Such a program is underway, assisted by an active, professionally eminent panel of consultants in psychiatry, neurology, and psychology, and encompasses the following broad areas of investigative effort:

Naval Medical Research Institute, Bethesda, Maryland

(1) The development of a systematic body of knowledge which can serve as a foundation for subsequent development of psychiatric assessment and preventive psychiatry programs appropriate to future Weapons Systems. Of particular importance is expanding research involving the selection and functioning of individuals in small groups under conditions of extreme isolation and stress over long periods of time.

(2) The investigation of Immaturity Reactions and Character and Behavior Disorders in naval recruits.

(3) The systematic identification of significant variables in the prognosis of individuals diagnosed schizophrenic in the Naval Service.

U. S. Naval Medical Neuropsychiatric Research Unit, San Diego, California

(1) The Special Environments Branch is engaged in an Operation Deepfreeze assessment program, with the goal of determining personality and environmental factors relevant to adjustment at small Antarctic stations.

(2) The Preventive Psychiatry Branch conducts programs in the areas of evaluation and improvement of the effectiveness of general neuropsychiatric screening, of psychiatric selection of personnel for specialized duty assignments, and of psychiatric screening of disciplinary offenders at the Brig level.

(3) The role of cortical activity in perceptual, motor, and cognitive performance in routine, clinical, and stress situations.

This overall program has been very considerably handicapped by the lack of sufficient numbers of trained psychiatrists. Personnel ceilings and budgetary limitations on the numbers of medical officers have not made it possible for us to defer sufficient numbers of psychiatrists under the Berry Plan or to have on active duty the required number of psychiatrists to implement fully the above program or provide the required degree of outpatient preventive psychiatry.

CLINICAL RESEARCH IN NAVAL HOSPITALS

## Clinical Investigations in Hospitals

"It has always been the philosophy of the Mayo Foundation that residents in clinical fields should supplement a complete well-rounded practical residency training with laboratory experience including research. It is our conviction that some laboratory research training is of considerable value to the clinician, even if he may never again carry out laboratory investigation. This thesis may be expounded as follows.

"Past research experience by a physician now entirely engaged in clinical practice sharpens his judgement and enhances his evaluation of reports in the medical literature. Experience in research warns against inadequacy of numbers of observations, faulty controls, inaccurate measurements, intrusions of chance and the inherent variability of life processes; it sensitizes the physician to incomplete evidence, increases his wariness of exaggerated claims, tempers his acceptance of enthusiastic predictions.

"Research reveals the painful difficulty of discovery. Nature guards her secrets jealously and is loath to reveal them.

"Research develops an alertness to the apparently inconsequential. In carrying out any research project, it soon becomes clear that it is essential to be forever on the alert for an unexpected observation sometimes seeming almost to be an accidental occurrence.

"Research provides lessons in teamwork.

"Research engenders a respect for persistent routine. The investigator patiently repeats the experiment again and again, week upon week, changing the procedure, perfecting the technic, analyzing the failures, month after month.

"Research also fosters a healthy skepticism of one's own conclusions, a familiarity with the scientific method, a concise formulation of a problem and its solution, all of which are invaluable ingredients of good clinical practice.

"Finally, research provides knowledge and familiarity with one of the highways of discovery. The study and reading essential in carrying out a research project, determining what has gone before in this area and what yet needs to be done, are as different from the more casual reading of such material as actually traveling a countryside is different from reading a highway map."

Victor Johnson, M.D., Ph.D.  
Director Mayo Foundation  
for Medical Education and Research  
Proceedings Mayo Clinic Oct 25, 1961

Clinical Investigation in Naval Hospitals -

USNH, Bethesda

The USNH maintains a program of research in Radiobiology with the objective of establishing methods for the diagnosis and treatment of radiation injuries. The Radiation Exposure Evaluation Laboratory (REEL) provides low background facilities for determining the quality, amount and distribution of received radiation, and offers unique opportunities to develop a methodology for treating the radiation casualty. This research is supported by the numerous facilities located at the National Naval Medical Center. The program is coordinated with current programs at the Naval Medical Research Institute and the future research programs at the Armed Forces Radiobiology Institute.

Naval Medical School

The Tissue Bank of the Naval Medical School maintains active research in two major areas of the medical sciences, tissue preservation and storage, and tissue transplantation. Applied research encompassing both these areas is continuing through the clinical evaluation of the freeze-dried homograph program which is currently following about 4,000 patients. At a more basic level, but with applied potential, various methods of frozen storage of viable tissue are being studied as well as experimental designs to further elucidate the tissue transplantation rejection phenomenon.

USNH, St. Albans, N.Y.

The USNH, St. Albans conducts a program of surgical research. The research group work closely with the surgical staff on problems associated with extracorporeal circulation and pulmonary physiology. Surgical

residents are assigned to assist with the research procedures and participate in the program.

USNH, Portsmouth, Va.

The Cardiopulmonary Function Laboratory at the USNH, Portsmouth, conducts a series of studies on cardiac problems and the evaluation of cardiac patients. The availability of this Research Service has significantly improved the diagnostic capabilities of the Cardiopulmonary Clinic.

USNH, Oakland, California

A Clinical Investigation Center supported by an ONR contract with the University of California provides a military and civilian team with special competence in the fields of renal physiology and metabolism. The support provided by the University contract provides an opportunity for the hospital staff to maintain an exceptional academic and research liaison.

Prosthetic Laboratory, USNH, Oakland

This Laboratory combines the clinical facilities of the Orthopedic Department with the design, development and manufacture of prostheses for the rehabilitation of military amputees.

USNH, Great Lakes

This hospital is cooperating with Naval Medical Research Unit No. 4, Great Lakes in the study of respiratory disease. It provides the Unit with clinical support and data processing facilities.

USNH, Jacksonville

This hospital conducts within the Department of Pathology, fundamental studies on bone marrow preservation and transplantation.

DENTAL RESEARCH

## DENTAL RESEARCH

### Background

There are two separate aspects of dental research in the Navy. The first is a research program conducted within the laboratories of the Navy and the second is a program of university-sponsored research conducted through the Office of Naval Research. Administration of these programs is accomplished in such a manner that the officer who has the responsibility for the intramural dental research program is also the professional associate to the extramural program of the Medicine and Dentistry Branch, ONR. This same officer also has the responsibility of the training programs of the Dental Division, Bureau of Medicine and Surgery, thereby assuring not only coordination between the two research programs but also the training of research orientated dental officers and laboratory assistants.

### General

Naval dental research activities exist to support the combat effectiveness of the Navy, and they must be alert to opportunities where their specialized assistance is needed. There are many indications that the rapid technical changes in naval warfare will provide continually increasing need for special dental research support.

In the over-all Navy dental research program, basic research is justified to the extent that it provides the support to clinical research and clinical practice that will result in better dental health for personnel of the Navy and Marine Corps. Most of the Navy's basic dental research is accomplished by universities and other civilian organizations through the contract program of the Office of Naval Research. However, limited basic dental research studies are conducted within Navy facilities to support clinical studies and to assure the full employment of researchers engaged in specific applied research projects.

### Intramural Program

The objectives of the intramural research program are threefold. The first objective is to provide applied or clinical research support to patient care. The second objective is to support specific programs of the Chief of Naval Operations such as those in Antarctica, submarines, bacteriological warfare and mass casualties. The third objective is to conduct basic research to support clinical or applied studies.

All active and contemplated research during the 1961-1970 period is aimed toward the solution of dental problems in three broad fields: (1) preventive dentistry, (2) environment and (3) human engineering in dentistry. Since dental decay is a constantly occurring progressive disease and since it occurs in 99.3 per cent of naval personnel, an increased effort in the prevention and treatment of this disease is essential if the oral and associated general health of personnel is to be maintained. This research will involve extension of studies already undertaken and the instigation of new studies in related fields. These studies in the preventive dentistry phase are related to the epidemiology, etiology and treatment of dental caries and periodontal disease; studies on the use of preserved tissue in surgery; the study of dietary supplements or dietary deficiencies in relation to cariogenic or cariostatic activity

and the development of new restorative or prosthetic materials to specifically meet the demands of military dentistry.

The studies related to environmental projects are specifically concerned with oral health as effected by the stresses of the closed environment of nuclear submarines, the effect of combat or operational stress, and the relation of the cold and isolation of extended service in Antarctica to the oral health.

The projects in human engineering in dentistry are concerned with entirely new technics of patient care in which the capabilities of non-professional personnel will be explored to determine if some of the technical aspects of restorative dentistry, which are at present the total responsibility of the dentist, can be allocated to them; and to further determine if the resultant change in the dentist's work habits can be tolerated by him on a long-term basis.

The Dental Corps has nine specific full-time billets for research assignments. These billets are for the most part included as integral units of fully established medical research laboratories. This arrangement allows for the fullest cooperative effort between dentistry, medicine and the allied sciences at the lowest possible cost. The actual cost in terms of money allocated from the research budget to carry on this dental research program is \$115,000.00.

#### Extramural Program

The extramural dental research program as conducted through the Office of Naval Research is one of support to universities and civilian laboratories to conduct basic research in support of the objectives of the intramural program. This program is intended to add continuity, specialized knowledge, and information to be used toward the solution of dental problems incident to a military population. The results derived from this program could not be duplicated intramurally, since the personnel working in the program are highly specialized within a specific field.

**LIMITED WARFARE**

SUBJECT: MEDICAL RESEARCH IN SUPPORT OF LIMITED WARFARE

Remarks by Rear Admiral C. B. Galloway, MC, USN,  
Assistant Chief for Research and Military Medical  
Specialties, Bureau of Medicine and Surgery, Navy  
Department

June 24, 1961

MR. CHAIRMAN:

I APPRECIATE THIS OPPORTUNITY TO DISCUSS WITH YOUR DISTINGUISHED  
TASK FORCE THAT PORTION OF THE MEDICAL RESEARCH PROGRAM RELATING  
DIRECTLY TO THE SUPPORT OF LIMITED WAR OPERATIONS. WITH YOUR  
PERMISSION I WOULD LIKE TO (1) REVIEW BRIEFLY THE PRESENT RESEARCH  
PROGRAM, (2) IDENTIFY DEFICIENT INFORMATION AREAS, AND (3) PROPOSE  
AREAS OF RESEARCH WHICH WILL CONTRIBUTE TO INCREASED LIMITED WAR  
CAPABILITIES.

OUR CURRENT RESEARCH PROGRAMS ARE FOCUSED ON THE MEDICAL PROBLEMS  
OF THE NEAR EAST AND SOUTHEASTERN ASIA. WE HAVE ESTABLISHED LABORA-  
TORIES AT CAIRO, U.A.R., AND TAIPEI, TAIWAN, FOR THE STUDY OF DIS-  
EASES ENDEMIC TO THESE AREAS. UNDER INTENSIVE STUDY ARE: SCHISTO-  
SOMIASIS, TYPHOID FEVER, THE DYSENTERIES, AMEBIASSES, TYPHUS, MALTA  
FEVER, CHOLERA, TRACHOMA, RESPIRATORY DISEASE, INTESTINAL PARASITES,  
AND KALA AZAR.

ONE MUST ASSUME THAT THE DISEASES OF WORLD WAR I, WORLD WAR II,  
KOREA AND LEBANON WILL CONTINUE AS MAJOR MILITARY PROBLEMS. CONTROL  
OF ALL INFECTIOUS AGENTS RESPONSIBLE FOR MILITARY EPIDEMICS IN THE

PAST HAS NOT BEEN ACHIEVED. HEPATITIS, DIARRHEAL DISEASES, HEMORRHAGIC FEVER, ARBOR VIRUSES AND RESPIRATORY DISEASE ARE EXAMPLES OF THIS GROUP. THE PREVENTION OF DISEASE AND THE MAINTENANCE OF HEALTH IN THE DISTANT LESS KNOWN AND UNDERDEVELOPED AREAS OF THE WORLD DEMANDS A PRECISE KNOWLEDGE OF: (1) THE DISEASES OF THE AREA, (2) THE SEASONAL FACTORS, (3) INSECT VECTORS, (4) DISEASE LEVELS IN THE LOCAL POPULATION, AND (5) THE RESPONSE OF ORGANISMS TO THERAPY. RESEARCH IN THE DISTANT AREAS OF THE WORLD PROVIDES INFORMATION WHICH IS ESSENTIAL TO THE SUCCESS OF LIMITED WAR OPERATIONS. OVERSEAS MEDICAL RESEARCH ALSO PROVIDES AN EFFECTIVE PERSON-TO-PERSON LIAISON WITH OUR ALLIES AT BOTH GOVERNMENTAL AND INDIVIDUAL LEVELS. THESE LABORATORIES CREATE OPPORTUNITIES FOR THE TRAINING OF MEDICAL DEPARTMENT PERSONNEL IN THE DIAGNOSIS, TREATMENT AND PREVENTION OF EXOTIC DISEASE. THE SUCCESS OF MEDICAL SUPPORT IN LIMITED WARFARE OPERATIONS DEMANDS ACCURATE MEDICAL INFORMATION, EFFECTIVE VACCINES OR DRUGS AGAINST THE AREA DISEASES AND THE AVAILABILITY OF SPECIFIC THERAPEUTIC MEASURES APPLICABLE TO THE FIELD. THE RAPID MOVEMENT OF TROOPS FROM A TEMPERATE ZONE TO THE HUMID TROPICS OR THE HOT, DRY AREAS OF THE WORLD CREATES MAJOR PROBLEMS IN ACCLIMATIZATION.

IN SUMMARY: TROOP MOVEMENTS IN LIMITED WARFARE WILL BE RAPID; MAXIMUM IMMUNIZATION LEVELS MUST BE MAINTAINED AT ALL TIMES; PRECISE MEDICAL INFORMATION MUST BE IMMEDIATELY AVAILABLE; THE HIGHEST LEVEL OF PERSONAL HYGIENE AND SANITATION AWARENESS IS AN ESSENTIAL ELEMENT OF ALL TROOP TRAINING PROGRAMS.

## FACT SHEET

1. The tropical and semitropical areas of the world abound with disease-carrying insects and mites. Mosquitoes transmit malaria, yellow fever, dengue, encephalitis, and filariasis. Houseflies contribute to the transmission of diarrheal diseases. Sleeping sickness is carried by tsetse fly and Pappataci fever by the sandfly. Mites transmit scrub typhus in Asia and fleas are worldwide vectors of plague. Lice transmit typhus and relapsing fever in many parts of the world. Historically, these diseases go back to the beginning of ancient times. Although much research has been done on these problems, the impetus given by World War II has slackened because of lack of funds and personnel. Further studies are required in the following areas:

- (1) Biology (natural history) of disease and distribution of vectors,
- (2) Better protective measures against the vectors, and
- (3) Additional work on chemotherapy and vaccines.

In limited military actions, general public health measures cannot be applied. Health of the troops will depend upon prophylactic measures taken prior to engagement and thorough indoctrination of the individual in utilizing existing protective measures.

2. Diseases of military importance for which there are no fully effective public health, preventive or therapeutic measures applicable for use in limited war situations:

- |                         |                      |                    |                   |
|-------------------------|----------------------|--------------------|-------------------|
| 1. Hepatitis            | 4. Tuberculosis      | 7. Leprosy         | 10. Leishmaniasis |
| 2. Diarrheal diseases   | 5. Scrub Typhus      | 8. Schistosomiasis | 11. Arbor virus   |
| 3. Respiratory diseases | 6. Hemorrhagic fever | 9. Trypanosomiasis |                   |

3. Infectious Disease Problems of World War II, Korea.

World War II (1942-1951) (Approximate figures)

Disease	Army	Navy-Marine Corps	Approximate Total Cases
Malaria . . . . .	378,100	113,700	491,700
Dengue	91,000	37,700	128,700
Typhus (total epidemic, endemic and scrub)	6,400	850	7,250
Smallpox	117	8	125
Hepatitis, infectious	181,000	16,800	198,800
Diarrhea and Dysentery	574,000	170,000	694,000

Filariasis: 10,400 cases were recorded from 38,000 Marines exposed during World War II.

KOREA: One (1) hospital was used for only infectious hepatitis. The average man-days lost was 56 days per case.

<u>Hemorrhagic fever, 1951-1953:</u>	Navy - 100 cases
	Army - 2,500 cases
	Total - 2,600 cases

FACT SHEET

4. The Influenza pandemic following World War I is estimated to have caused 20 million deaths worldwide. There were 548,000 deaths in the United States and 50 times that number of cases.

Malaria--In the Guadalcanal-Solomons Campaign there were 4 casualties from disease for each battle casualty.

CATEGORY: MEDICAL RESEARCH LIMITED WAR

**ADVANCED OR FUTURE RESEARCH REQUIREMENTS**

Current and Future Medical RDT&E Program Elements and Program Packages  
1961 - 1970

I. Current Programs

A. Submarine Research (the closed environment)

1. Personnel selection, training, and motivation
2. Health hazards evaluations
3. Interpersonal relations, closed and restricted environments
4. Hearing

B. Aviation Medical Research

1. Disorientation
2. Selection, training, and motivation
3. Physiological flight parameters

C. Neuropsychiatric Research

D. Diseases of Military Importance

1. Acute respiratory disease..recruit populations
2. Viral disease..hepatitis, hemorrhagic fevers
3. Remote area disease and insect vector control

E. Blood Preservation and Tissue Transplantation

F. Preventive Medicine and Treatment of Trauma

II. Mid-Range Programs

- A. Submarine Research (as required by operational experience)
- B. Aviation Research (as required by operational experience)
- C. Personnel Identification, Selection, Training, Motivation, and Retention
- D. Diseases of Military Importance
- E. Basic Immuno-Chemistry (tissue transplantation, immunization)
- F. Acclimatization and Fatigue
- G. Biological Control of Insects

III. Long-Range Programs

A and B. As required by operational experience and engineering developments

C,D,E,F,G. As determined by operational experience and new weapon concepts

**RESPONSE CAPABILITIES**

### OPERATIONAL RESPONSE CAPABILITIES

The ability to respond immediately, effectively, and constructively to emergency military operational problems is an important attribute of the research organization.....capable of identifying and defining the problem, and capable of obtaining without delay the industrial or academic consultation essential to a solution of the problem.

The nuclear submarine generated the problem of the long term closed environment. The solution extended existing knowledge derived from conventional submarine operations supplemented and supported scientific contributions from almost every element of the scientific community....industry, university, and individual.

The long term preservation of blood has achieved its present status by the combined efforts of the Chelsea Naval Hospital, the Protein Foundation of Boston, and the engineering services of the Arthur D. Little Company, Boston. An effective response by an effective task force.

Cholera appeared in Bangkok in 1958....NAMRU-2 responded immediately and placed a research task force in Thailand assisted by the National Institutes of Health, Walter Reed Army Institute of Research, and the University of Pittsburgh. Cholera became epidemic in Hong Kong in 1961...NAMRU-2 again proferred their assistance and contributed to the identification of the etio-

logical agent....within the past two months cholera (El Tor vibrio) became epidemic in the Philippines. NAMRU-2 has a field research team in Manila that has guided the clinical management of the victims and has continued the research studies originated in Bangkok in 1958. Assisted in this instance by the World Health Organization, the National Institutes of Health, the Southeastern Atlantic Treaty Organization (SEATO) Research Staff, and Walter Reed Army Institute of Research.

Viral pneumonia became epidemic at the Great Lakes Naval Training Command on 1 October of this year (658 cases hospitalized on 17 October) NAMRU-4 responded to the operational and research demands of the situation and within days focused the attention and efforts of consultant groups, the Armed Forces Epidemiological Board and the National Institutes of Health on this problem.

The opportunity to study trachoma in an almost ideal clinical situation in Taiwan was recognized and implemented by NAMRU-2. A Trachoma Center for basic laboratory and field support was organized, assisted by and supporting the University of Chicago, the University of Washington, Harvard University, and the World Health Organization. The latter plans a five-year clinical study in Taiwan to continue and expand the efforts of NAMRU-2.

Thermal stress of temperature extremes and the acclimatization parameters following global troop movements are military problems. Research encompasses clinical studies of heat casual-

ties, preventive measures, physiological responses to field induced stress, cooperative studies with the United States Army in Panama and the British Army in the Crown Colony of Aden. We are following with extreme interest the recent experiences of the British in Kuwaite.

ADDENDA

KALA AZAR	Dr. H. Hoogstraal
SUBMARINE RESEARCH	CAPT. G. J. Duffner, MC, USN
CLINICAL INVESTIGATION	Dr. H. T. Karsner
AIRCREW EQUIPMENT	Staff Report
PHYSICAL STANDARDS	CAPT R. E. Walsh, MC, USN
BIOLOGICAL AND CHEMICAL WARFARE DEFENSE	LCDR C. H. Miller, MC, USN

### KALA-AZAR

In 1958, the Sudan Government, through its Ministry of Health, requested NAMRU#3, (Cairo, Egypt) to study the epidemiology of Kala-Azar and to recommend measures for control of this disease. Formal arrangements to do so were made in 1959, together with a preliminary survey of the endemic area, and early in 1960 a substation of NAMRU#3 was dedicated, in ceremonies attended by Ministry, diplomatic and governmental personnel, at Malakal, Upper Nile Province, about 500 miles south of Khartoum.

Kala-Azar is endemic in a vast area of the central grasslands of eastern Sudan and is believed to be extending its range west of the Nile. It is also common in northern Kenya and occurs in other parts of East Africa (Ethiopia and Somaliland) and westward to the Atlantic. Fear of Kala-Azar in Sudan is an obstacle to the development of vast grassland resources, resettlement of peoples from the northern reaches of the Nile Valley soon to be flooded by construction of the new Aswan Dam in Egypt, and to assignment of government officials, and military forces from non-infected areas of the Sudan, where most of the educated, articulate, and sophisticated peoples of the Sudan live.

Kala-Azar has been endemic in the Central Grasslands of the Sudan since the beginning of recorded history, and periodically occurs in epidemics that seriously reduce the numbers of native peoples. Accurate data on the incidence are, however, unobtainable. The Sudanese variety of Kala-Azar appears to be exceptionally difficult to cure and may be aggravated by the low nutritional standards in the endemic area.

Results of NAMRU#3's preliminary survey suggested that a whole new battery of research techniques would have to be developed in order to achieve its goal in a period of three to five years. Much effort in this direction is being made by the NAMRU#3 staff in Cairo and in consultation with outstanding workers in the United States and elsewhere. Even at this early date, results of new fluorescent antibody techniques for detection of infected sandflies, devised at NAMRU#3 during the past summer are so promising that they may reduce by several years the period of field study necessary to indicate vector species, incidence, seasonal periodicity, and areas in which infections are acquired.

An epidemiological study of Kala-Azar in Sudan is exceptionally difficult, not only because of the remoteness of the underdeveloped area in which this work must be done, but also because of the very many questions that must be answered to solve the problem. The vector or vectors are unknown. They are presumed to be sandflies, but many sandfly species with greatly differing biological patterns inhabit the Sudan. A major study is being devoted to sandfly species biting man, their distribution, feeding habits, seasonal cycle, flight and resting habits, breeding places, susceptibility to infection, and ability to transmit the causative organism. Considerable progress has already been made in this direction; after a few weeks of field work we know the species that bite man in certain infected villages and in the field and during which months they bite.

Results such as these have taken workers elsewhere years to obtain. Highly qualified specialists are presently being obtained on one to three year contracts to investigate other aspects in this area of research and to continue the preliminary studies.

Presumably the disease is transmitted to man by an insect (probably a sandfly) from a wild or domestic animal, but such reservoirs are often extremely difficult to detect. New techniques to reveal infected reservoirs are presently being developed and personnel are being trained to carry these techniques to the field. At the same time, the possibility of a man-insect-man cycle is being investigated and plans are being made to study the potential of human contacts as a means of transmission.

Early diagnosis of Kala-Azar is virtually impossible and large scale tests to determine the area and incidence of previous exposure to the disease are at present uncertain. Vigorous efforts are being devoted to rapid and certain means for solving these very important problems.

Numerous clinical aspects of the disease are poorly known or totally unstudied and NAMRU#3 clinicians are giving these much study. The question of increased susceptibility to the disease by poorly nourished people will be studied by a team from Vanderbilt University.

Owing to the possibility that exposure to leishmania of lizards may provide immunity to humans, a large scale study of lizard and other animal leishmania in this area will be made.

Since this disease in the Sudan is exceptionally difficult to cure, a therapeutic study is also planned.

Possibilities of different cycles of transmission in different ecological areas and in chronic and epidemic situations are being investigated.

Difficulties of these studies are increased by long rains, which turn the entire endemic area into a vast swamp for several months of the year; severe heat and distance from water at other times of the year; remoteness from supplies, spare parts, and well-established laboratory facilities; lack of trained local technical staff; great distances that must be traversed over rugged terrain, etc. Local peoples are, however, pleasant to deal with and the Sudan government officials are understanding and sympathetic.

Harry Hoogstraal, PhD  
Department of Medical Zoology  
NAMRU#3 - Cairo, Egypt, U.A.R.

## SUBMARINE AND SHIPBOARD MEDICINE RESEARCH PROGRAM

The Submarine and Shipboard Medical Research Program is designed to provide knowledge concerning the functions, behavior, and limitations of the human organism in a Naval environment. In operational situations, the end point of individual performance can be viewed as a vector whose length and direction is the resultant of many influences. Among these are the ability to receive information, general state of health, environmental conditions, aptitudes and interests, and finally such ill-defined qualities as motivation and emotional stability. To obtain information applicable to this complex milieu, a multi-disciplinary approach becomes mandatory. This program comprises the disciplines of physiology, medical psychology, psychophysics, and biophysics. The program is administered under 14 tasks, 12 of which are located at the Naval Medical Research Laboratory. Brief descriptions of the tasks receiving major support follow.

One of the principal fields of research has been the psycho-physical studies of visual and auditory factors in submarine operation. Vision research has been directed in lines designed to increase our fundamental knowledge of the process of visual perception. This program has produced extremely useful information concerning night vision and color perception. The auditory research program has been directed along lines which will increase our understanding of hearing within a closed environment. This is of first importance because the "eyes" of the submerged submarine is the sonar apparatus. The noise problems arising out of the advent of high-energy sonar are under investigation. This program is also concerned with hearing conservation.

Both a psycho-physiological and psychological approach are being applied to the problems of submarine personnel assessment and selection. The psycho-physiologists seek to identify visual and auditory requirements in various submarine jobs and develop means for testing applicants. The psychologists are currently attempting to identify the factors affecting the maintenance of personnel motivation and group morale during prolonged submarine submergence. Another approach focuses on the experimental delineation of the somatic processes which may be usefully predictive of individual differences in adjustment to submerged conditions.

In view of the long submergence capability of our nuclear submarines, the matter of closed space ecology is receiving major attention. During the past year, bio-chemical investigations have been pursued to extend our knowledge concerning the effects of atmospheric contaminants on enzyme systems. The effects on pulmonary function of breathing air containing a preponderance of positive or negative ions is under investigation.

Research is in progress at the Naval Medical Research Institute on the physiological effects of vibration. Animal experiments have been completed which identify the pathologic effects of mechanical vibration on the heart, lungs, and intestinal mucosa. Functional changes in cardiac and respiratory behavior are also under study.

### FUTURE PLANS

In formulating these plans, the following assumptions were made:

- a. That there will be increasing emphasis on undersea warfare.
- b. That submarines will continue to be carriers of major war deterrent weapons systems.
- c. That major improvements and advances are required in SCUBA to increase the effectiveness of underwater demolition and explosive ordnance disposal personnel.
- d. That there is a need for improving our capability in deep diving.

During Fiscal Years 1962 through 1965, the research program in vision will be reduced to the minimum capability essential to the needs of the Medical Department of the Navy. The research program in audition should be increased by approximately 50% during this period. A basic research program in neuropsychiatry dealing with the problems of isolation and small-group performance is planned. A program is under consideration to investigate more realistic means for conducting health hazard evaluations, utilizing performance rather than damage criteria. Research in underwater physiology must be continued.

During the Fiscal Years 1965 through 1967, the research program in audition should be increased twice the current level. During this period, the support level for the neuropsychiatric research program should approximate \$500,000. By 1965, we should be in a position to begin the study of the effects on man of exposure to mixtures of atmospheric contaminants. During this period, the effort in underwater physiology should also be increased. The ideal situation would be to have a team consisting of a submarine medical officer, a physiologist, a psychologist, and several technical personnel (preferably hospital corpsmen) who would act both as technicians and subjects.

During the period 1968 through 1971, neuropsychiatric research should have developed sufficient information for a field validation of its findings. During this period, the study of the effects of mixed contaminants on man exposed for prolonged periods should be increased.

Captain G. J. Duffner, MC, USN  
Head, Submarine Medicine Division  
Bureau of Medicine and Surgery

## CLINICAL INVESTIGATION

The mission of clinical investigation in Naval hospitals is twofold: one is tangible in that it improves greatly the care of patients of all kinds in the hospitals and two, intangible, in the effects it has otherwise.

The contribution to medical practice is in terms of new knowledge, techniques and methods of patient care. Undoubtedly this raises the standard of medical care. The presence of well-developed clinical investigation provides information and assistance in the diagnosis and care of patients which might not be available in the routine hospital laboratory.

In addition to vast improvement in the care of patients, there are other benefits. Clinical research is characterized by precision, thoroughness and accuracy, all of which are exemplary to the clinicians in their study of and care of patients. The investigators may provide the clinicians with an interpretation of new discoveries which might otherwise not be readily available. The training of younger physicians is benefited and correspondingly there may be stimulating effects on all hospital personnel, both professional and administrative. Many of our hospitals are in an urban environment; thus the fact that the military hospital is conducting investigative work is of great value in the necessary association with the civilian hospitals and practitioners in the neighborhood. This provides for the active participation by Naval medical officers in the medical life of the community. The fact that clinical investigation is conducted makes the hospital increasingly valuable to the staff and in the attractiveness to those recent graduates who wish appointments as house officers.

The development of clinical investigation in Naval hospitals places them on a par with their civilian counterparts, and because of the nature of the patients, both within the hospital and in the out-patient service, provides opportunities for study that are not readily available in civilian hospitals.

To project clinical investigation over a ten-year period depends on various factors. Thus the personnel strength of the Service must be indicated because on this depends the number of doctors available. The pattern of disease has changed in the course of the last fifty years to a remarkable degree and this may be projected into the next ten years. Thus diseases of importance at the present moment may decrease in prevalence and other diseases may increase in prevalence with this passage of time. The development of new techniques will alter the direction of clinical research. To offer projection of ten years in specific terms is impossible.

Howard T. Karsner, M.D.  
Research Advisor to the  
Surgeon General

THE LIFE SCIENCES RESEARCH DIVISION  
OF THE AIR CREW EQUIPMENT LABORATORY

As indicated previously, the Air Crew Equipment Laboratory conducts basic and applied research in the biologic, psychologic, and human engineering aspects of aviation medicine as it pertains to the personal and safety equipment of naval aircrewmen and spacecrewmens and to their ability to perform satisfactorily under all stresses of their environment. It also engages in engineering and biologic research and development in the fields of aircraft nuclear propulsion and space and orbital flight in anticipation of future aircrew or spacecrew equipment requirements as projected trends in naval aviation and astronautics become apparent. In order to carry out this mission, particularly with regard to the physiological, psychological, and human engineering aspects, the Life Sciences Research Division is broken down into three branches: the Respiration Branch, the Human Engineering Branch, and the Environmental Stress Branch.

The Respiration Branch is the physiological counterpart of the engineering Oxygen Equipment Branch. Whereas the latter is concerned primarily with hardware design, development and evaluation, the former conducts studies to determine the physiological adequacy of oxygen breathing equipment and the suitability of closed environments for prolonged human habitation. Fundamental studies have been done on determining the physiological dead space in pressure suit helmets and the effects of added dead air space on subjects doing various amounts of physical work both at sea level and at altitude. Oxygen consumption studies have been carried out on subjects wearing the full pressure suit while performing flight-simulated tasks and, more recently, a proposed bio-instrumentation package designed for airborne

use has been evaluated. The Respiration Branch has played a major role in determining the criteria which will be used to evaluate closed environmental systems for space use. These criteria have been partially established as a result of the valuable experience gained in two confinement studies during which a group of men were confined for periods of about a week in a relatively small space. These confinement studies were the forerunners of many others to be conducted in the evaluation of chemical, closed-loop breathing systems which have direct and immediate application to satellites and space vehicles carrying living organisms. The Branch is presently assisting NASA in evaluating the gaseous environment of the Project Mercury capsule. In addition, studies are being conducted on useful consciousness time of subjects breathing from the gas supply trapped within their pressure suits.

The Human Engineering Branch is primarily concerned with those aspects of the cockpit and space vehicle which affect the pilot's ability to most efficiently do his job. One broad area of the Branch's work is concerned with lighting - both inside and outside the aircraft. Another area involves the design, arrangement, and configuration of aircraft cockpit displays and controls. The introduction of the full pressure suit - as well as other protective equipment worn by flying personnel - has given rise to many new problems in human engineering. One of these concerns the physical size of these personnel, and their ability to see and manipulate their controls. In this connection, an anthropometric study of naval flying personnel has just been completed, and the results reported. Another of the Branch's most recent efforts concerns the fluorescent painting of aircraft fuselages and propellers to maximize their visibility and reduce the probability of

mid-air collisions. The Branch is also playing a prominent role in the design and standardization of devices to prevent flash blindness. Members of the Branch are very active in mock-up meetings of the latest naval aircraft, and they also participate in the activities of panels and committees which establish standards for cockpit components. Some of the factors studied by the Branch are size, shape, color and lighting of switches, knobs, nameplates, instruments, hand-grips, and related items used by the pilot to fly his aircraft. In the confinement studies conducted by ACEL, and mentioned above, the Human Engineers planned and designed the internal configuration of work, sleep, and leisure spaces, and they will be responsible for the same aspects of the ACEL Bioastronautical Test Facility.

The Environmental Stress Branch has been active in conducting studies which attempt to delineate the psychophysiological effects on flying personnel of their immediate environment, in terms of specialized clothing and protective gear, and the more remote environments of the enclosed, pressurized cockpit and the ambient surroundings, such as the sea, the skies, and outer space. One of the most critical stresses of practical significance for operational aircraft is thermal in nature. The Branch has conducted studies to determine the effects of extreme temperatures on human subjects, and has physiologically evaluated a wide variety of protective clothing assemblies designed to reduce heat and cold stress. In the course of these investigations, new equipment, instrumentation, and techniques have been developed. For example, one of the most recent devices developed has been an automatic skin temperature programmer which utilizes thermistor sensors and associated electronic circuitry to provide a visual, digital temperature

indication as well as automatic printout. Studies have also been carried out, using rats, on the physical and physiological effects of rapid and explosive decompression. In a unique study, pressure-suited operators successfully dissected and fixed explosively decompressed animals at an altitude of 65,000 feet. This study not only demonstrated the pathological effects of explosive decompression, without introducing the artifact of recompression, but it nicely showed the mobility and finger dexterity possible in a fully pressurized suit. Studies on the response of subjects to some conditions involved in the orbital flight patterns of Project Mercury have also been conducted. Project Mercury astronauts as well as Laboratory naval personnel participated as subjects in these studies. In connection with the Laboratory's space flight programs, the Branch has been actively engaged in determining the most sensitive physiological indices as stress indicants, and has been correlating these indices with changes in performance. For example, a search for the presence of biochemical "fatigue" substances in urine and blood is being conducted, and a variety of personality and performance measures are being analyzed and experimentally tested. The stress of isolation under conditions of reduced external stimuli is being investigated, and the effects of group confinement on perception and personality have been determined.

In addition to the applications of physiology, psychology and human engineering to current practical problems, a number of more basic problems are investigated by members of the Laboratory staff in connection with BUMED assigned tasks. The relationship of muscle action potentials to breakdown of work in task oriented subjects has been studied, and some of the effects of hypoxia on auditory sensitivity have been investigated. Analyses have been made of tissue noise and muscle action potentials; auditory threshold

shifts of hypoxic subjects in a quiet environment have been determined.

The technique of auditory reflex tympanomanometry has been developed and auditory reflex reactions to jet engine noise studied. A basic investigation of the physiological mechanisms of temperature sensation is being carried out, and various kinds of radiant energy, including microwaves, have been used to heat tissues and elicit temperature sensations.

## PHYSICAL STANDARDS

PURPOSE. Physical standards are established to secure uniformity in conducting physical examinations and interpreting physical fitness of candidates for and persons in the naval service. The object is to procure and retain personnel who are physically fit and temperamentally adaptable to provisions of military life. Physical standards are based upon past experience and the known instances of certain diseases in the military service; public scientific study in the field of medicine; professional requirements of the military service, and statistical data developed by civilian life insurance companies.

RESEARCH. The Surgeon General is responsible for a continuing evaluation of existing and proposed physical standards and a correlation of such standards with naval experience. In addition to formal research projects, certain statistical studies are under consideration or are in progress within the Bureau which are intended to test the validity of present physical standards and policies for procurement, assignment, retention and/or disposition of members of the naval service. The studies either in process or under consideration are as follows:

Validity of standards for entry into service. Under consideration is a ten-year follow-up study of individuals with certain defects who are accepted with a waiver of the physical standards. The purpose of this study is to determine those defects which may constitute an acceptable minimum of incurred risks as concerns liability in regard to health hazards, repeated or prolonged hospitalization, assignment problems, and an eventual pension and retirement benefits. This study should indicate those areas in which the physical standards may be lowered as well as those conditions for which the standards should not be waived.

Validity of physical risk classification. Under consideration is a study of the effects upon the mobilization capacity and the impact upon the physical disability retirement system of granting waivers for physical defects to permit retention of physically sub-standard officer members in the inactive Naval and Marine Corps Reserve.

Unilateral Blindness. A ten-year follow-up study (by year groups) of members of the naval service retained on active duty after loss of one eye. The purpose of this study is to determine a member's ability to serve and perform the various skill requiring duties despite unilateral blindness. Also, to determine whether such individuals are more accident prone than those with binocular vision.

Arteriosclerotic Heart Disease. Under consideration is a plan to conduct a statistical study of personnel diagnosed as having arteriosclerotic heart disease during the years 1950 and 1951. The purpose of this study is to determine the validity of the Bureau's policy of not returning such individuals to full unrestricted duty. It is anticipated that this study

may possibly be expanded to cover persons in additional year groups.

In addition to the foregoing, statistical studies involving diabetes, tuberculosis, epilepsy, and hearing defects are all desirable and perhaps in view of the rising cost of physical disability retirement, imperative.

PROBLEM. The 11 million or more medical records of members and former members of the naval service on file contain a wealth of data for statistical study. However no practical, economical and speedy method for retrieving such data from these records has yet been developed. While certain preliminary investigations have been conducted with a view towards developing a method for machine retrieval of the data, the results to date have not been encouraging. Under methods now available, retrieval of information from these records is a laborious time consuming review of individual records. Such a technique permits the conduct of only those studies most pressing at the moment.

BACTERIOLOGICAL AND CHEMICAL WARFARE

BACTERIOLOGICAL AND CHEMICAL WARFARE - 1961-1970

The Department of the Army has been assigned prime responsibility for RDT&E in these fields.

This Bureau manages two activities, and contributes financial support to an ONR managed activity, which are conducting or cooperating in biological investigations of special interest to the Navy from a defensive aspect.

The projects under current investigation are directed toward the development and evaluation of BW medical countermeasures for Naval application and to determine the epidemiology of air borne infectious diseases. It is not contemplated that other projects will be initiated in the next ten years. However, significant technological advances or intelligence information may suggest modification during the annual reviews.

This Bureau currently provides approximately \$300,000.00 for support of the above tasks. It is estimated that financial requirements for support of these investigations will approach \$500,000.00 by 1970.

This Bureau is not conducting or supporting research in chemical warfare defense.

The major problems of this Bureau in biological warfare defense are related to development of reliable and rapid detection and identification of biological agents in the field and aboard ship, and to the development of effective vaccines containing multiple antigens.

This Bureau is interested in the results of investigations conducted or supported by other Bureaus and offices of the Navy Department and other agencies which relate to external devices which offer personnel protection against the effects of biological and chemical agents.

LCDR. C. H. Miller, MC, USN